# Siberia Mining Corporation Pty Ltd

A subsidiary of OraBanda Mining Limited
ABN 97 097 650 194

# Siberia Gold Operations
# Application for Purpose Permit Application
# To replace CPS 6968/4
# M24/39, M24/960, M24/208 and L24/224

May 2026



| | | | |
|---|---|---|---|
| **Document Title:** | Siberia Gold Operations-Application for Purpose Permit to replace CPS 6968/4 M24/39, M24/960, M24/208, L24/224 - | | |
| **Document No:** | **OBM**-SGO – PPA-0526 | PROJECT J00084 S0231752 | |
| **Type: (Tick Box)** | Controlled ☐ Uncontrolled ☑ | Issue A Revision 1.3 | |
| **Contact Detail:** | [redacted] | | |

| | | |
|---|---|---|
| **PROJECT OWNER & TENEMENT HOLDER** | OraBanda Mining Limited<br>PO Box 1868<br>SUBIACO WA 6904<br>ABN: 97 097 650 194 | Siberia Mining Corporation Pty Ltd<br>Level 2, 1 Hood St<br>Subiaco WA 6008<br>ACN:097 650 194 |
| **CONTACT DETAILS** | Perth Office:<br>Phone:+61 (0)8 6365 4548<br>Email: leanne.james@obmltd.com.au<br>Leanne James – Environment Manager | |
| **COMMODITY** | Gold | |
| **PROJECT DESCRIPTION** | The Siberia Gold Operations (**SGO**) forms part of the broader Orabanda Mining Limited (**OBM**) Davyhurst Gold Project (**DGP**) and includes underground mining activities within the Siberia Gold Operations (SGO) The Project is located 75 km northwest of Kalgoorlie and 25 km north of Ora Banda. Clearing Permit CPA 6869/3 was approved in May 2017 with an authorized clearing area of 96ha. The Permit expires on May 28, 2026.<br><br>After discussions with DMPE the amendment application for this permit will expire prior to the assessment being finalised and therefore OBM are resubmitting the clearing permit as a new application under the guidance from DMPE, Native Vegetation Branch.<br><br>The SGO includes the underground operations within the Sand King Open Pit and associated support infrastructure. There are existing open pits within the project which include the Missouri and Sand King deposits. Both have been the subject of modern, intermittent mining activity since the 1980's with the open pit completion in early 2025. Ore is trucked 35km on public and mine roads for treatment at the Davyhurst Mill. The current LOM is 5 years although the surrounding areas are highly prospective.<br><br>New infrastructure proposed includes extension of existing Waste Rock Landforms, internal mine roads, and for support infrastructure to the mining operations. Sustainability opportunities arising from the proposed mining and vegetation clearing activities include burial of the legacy Sand King TSF and utilization of any excess cleared vegetation as a growth medium for the rehabilitation of historic disturbed areas. | |
| **THIS CLEARING PERMIT AMENDMENT APPLICATION** | This Application for Purpose Permit is for the proposed clearing of an additional 96ha over M24/960, M24/39, M24/208 and L24/224 covering proposed minesite and infrastructure expansion at the Siberia Gold Operations. This application is to replace the existing CPS 6968/4. The clearing, using mechanical methods will take place progressively over 5 years as the project is developed and new areas are required for waste rock disposal. Cleared vegetation will be tracked rolled and stockpiled in secure areas for later rehabilitation use. Assessment against DWER's 10 Clearing Principles indicate that none are at variance or likely to be at variance if the Proposal is adopted. | |
| **RELEVANT TENEMENTS** | M24/960, M24/205, L24/224 and M24/39 | |
| **DISTRIBUTION** | DMPE- Native Vegetation Assessment Branch | |
| **AUTHORIZED FOR SUBMISSION** | Andrew Czerw<br>General Manager - Resource Development Date: 27.05.2026 | |

CONTENTS

# Contents



## LIST OF FIGURES



## LIST OF TABLES



## ATTACHMENTS

**Attachment A-**
Vegetation and Flora SurveySiberia Gold Operations - Project Development Area (JBBC 2019)
**Attachment B-**
Targeted Fauna Survey - Siberia Operations Area Biostat Pty Ltd (2019)
**Attachment C-**
M24/39 Gardner Agreement
**Attachment D-**
Tenement Summary
**Attachment E**
Purpose Permit Application

# 1. INTRODUCTION

## 1.1 Background to Project

The Siberia Gold Operations (**SGO**) forms part of the more extensive Orabanda Mining Limited (**OBM, Company**) Davyhurst Gold Project (**DGP**) and is the location for the Sand ing Underground Operations at the historic Siberia Goldfields in the Eastern Goldfields of Western Australia. Siberia is located 75 km northwest of Kalgoorlie and 25 km north of Ora Banda (Figure 1).

While the Siberia area has a gold mining history dating back to 1897, recent modern (pit) mining and processing activities are recorded as having commenced at the Sand King Pit in 1984 when a modest Plant and TSF were constructed. Subsequently, approvals for mining the Sand King, Missouri Camperdown and Palmerston Pits were sought by several parties, during the period 1987-2018 to provide supplementary ore to nearby processing plants. In the most recent mining campaign by Eastern Goldfields Limited (EGL), mining activities were suspended in September 2018 following a brief startup programme, and the operation was again placed on care and maintenance.

The current Mine Plan involves the progression of the Sand King Underground and establishment of a 250 person accommodation village to support the Project. Life of Mine with current resources is 5 years.

### Current Status

The Siberia Gold Operations (SGO) is a brownfields mining site and the mines continue to be active.

There is currently an informce Clearing Permit (Purpose) CPA 6968/4, which was approved in May 2017 with an authorized clearing area of 96ha id sute to expire on the 28 May 2026. However the application for amendment of time will not be assessed in time and therefore MPE have suggested another CPS application should be submitted in its place

Figure 1 outlines the Siberia Gold Operations regional land use and Figure 2 outlines the existing CPS 6968/4 which this application hopes to replace.

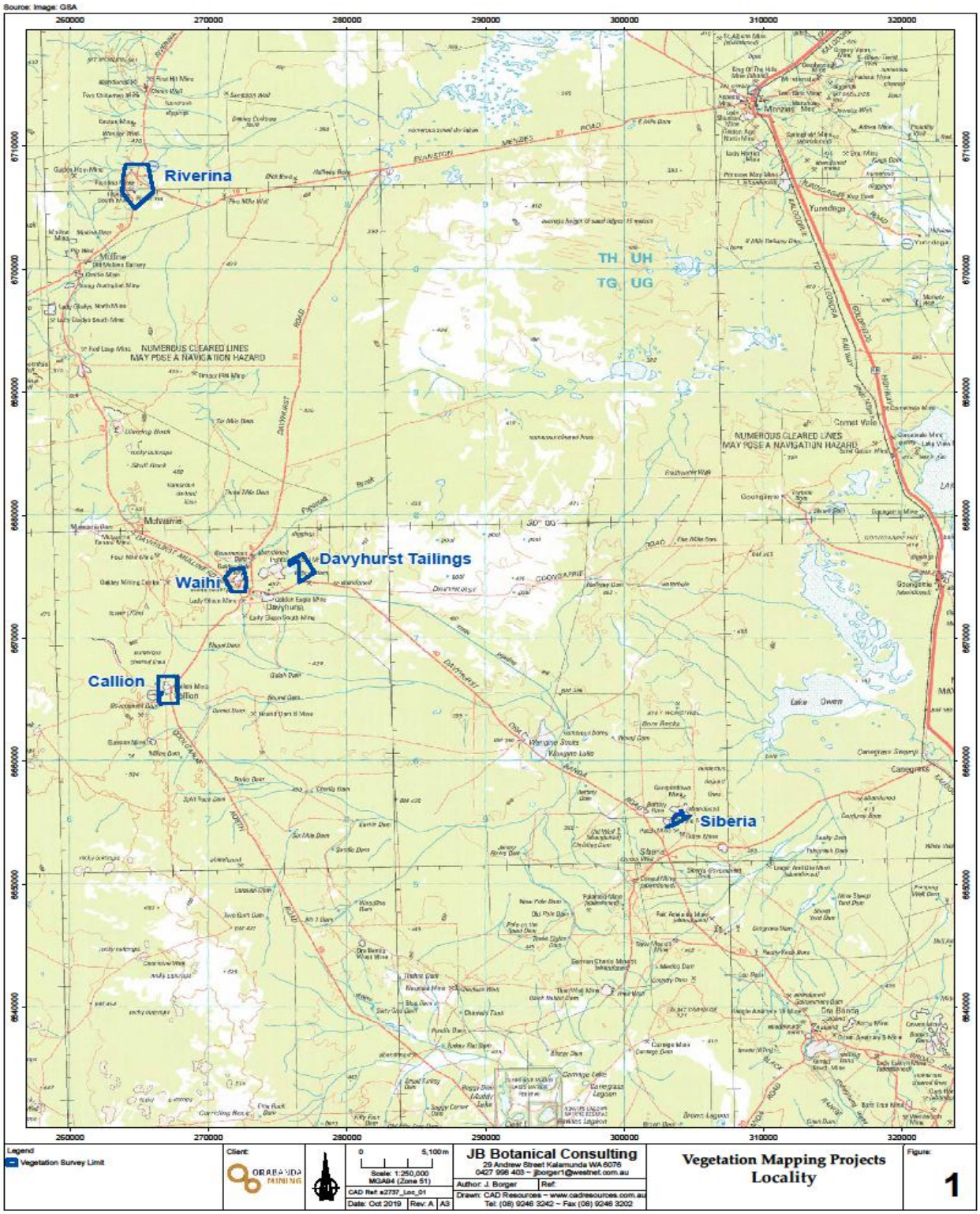



Figure 1: Regional Land Use and Access

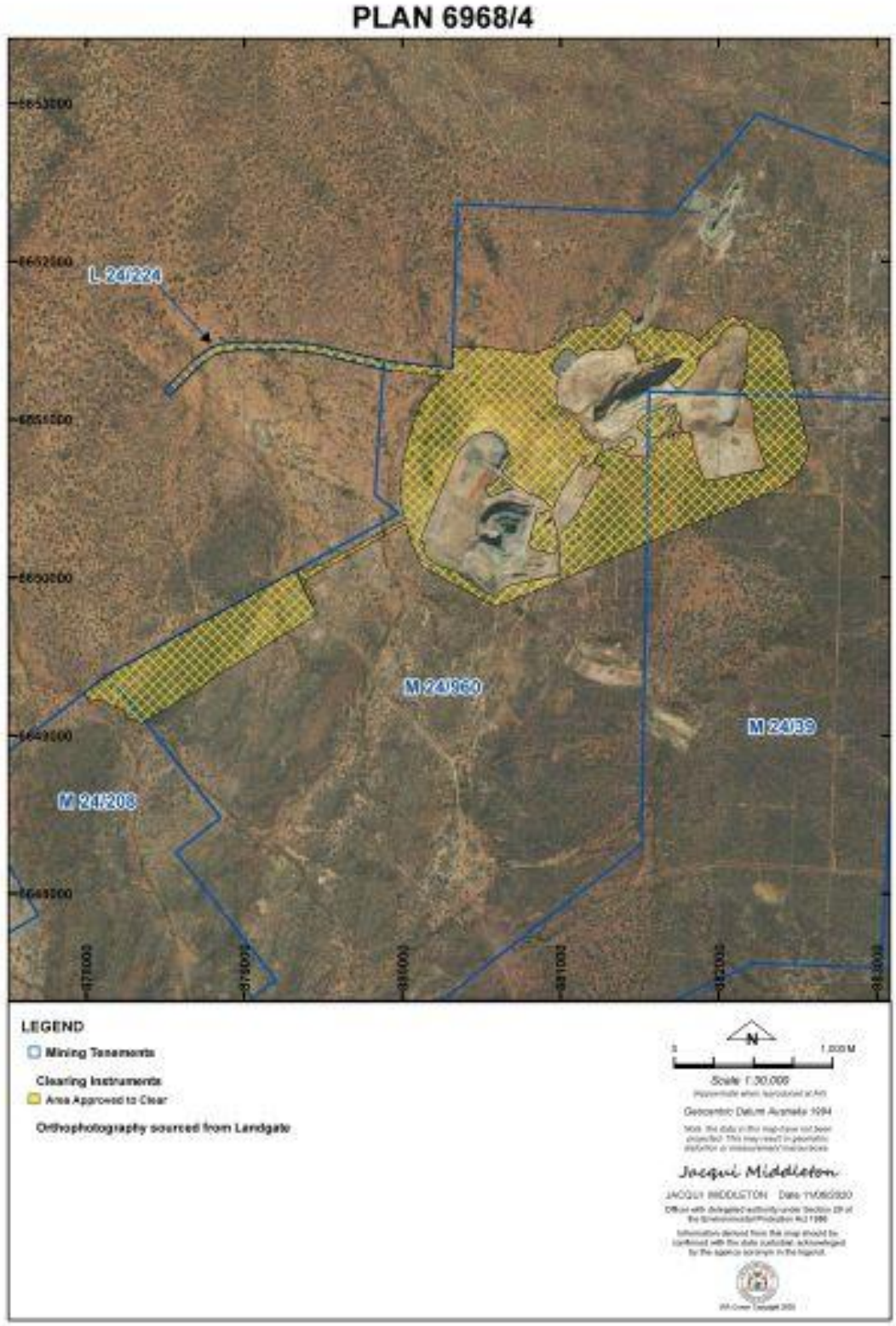



**Figure 2: CPS 6968/4 - Approved Clearing Areas (Yellow) and new Application Area**

# 2. EXISTING ENVIRONMENT

The district is dominated by granite-greenstone terrains of the Yilgarn Craton, which consists of a series of low ranges separated by flat plains derived from colluvium and alluvium deposition. According to the Interim Biogeographic Regionalisation of Australia (IBRA), Ver 7, the SGO is located south of the boundary between the Murchison Region (Eastern Murchison MUR-01 sub region) and the Coolgardie Bioregion (Eastern Goldfields COO-03 subregion).

The area is dominated by two topographical characteristics: Eucalyptus/mulga woodlands located on small stony rises and Eucalyptus woodlands on sandy clay sheetwash plains The soils of the eastern goldfields have been described in general terms by Beard (1978); comprising sandy loams, although skeletal stony soils occur on the rocky ridges, sands i n
the dunes, and sandy clays in the bottomlands.

The land is generally of low relief with erosional escarpment (breakaways) north of the Project area (Pringle et. al. 1994), bordering areas of laterite development, stony rises formed by more resistant mafic rocks, dropping down to local increasingly saline drainage bottoms and large playa lake systems.

Drainage systems referred to as paleodrainages extend from the western regional divide and extend easterly into Ponton Creek. These drainages have low gradients, and at intervals daylight as local playas. Calcrete is found exposed in deltaic situations in salinas in the northern part of the Goldfields and have been mapped in some detail for water supplies but are rarely found (Butt et.al. 1977) south of the Menzies Line -30°00´S (Pringle et.al.1994)

The Siberia Operations cover the highly prospective central portions of the Mt Ida Greenstone Belt midway between Mt Ida and Coolgardie on the Mt Burgess Pastoral Station. The area has been degraded locally by historic grazing, timber cutting, exploration and mining activities.

## *2.1 Climate*

The climate is typical of the south Murchison Area and is characterised by a Semi-desert Mediterranean climate. Dry weather occurs for 9 to 11 months of the year, summers are hot and dry, and winters are mild and wet with unpredictable rainfall. With the prevailing winds ranging east-south easterly, the air has a lengthy passage overland and therefore produces little rain. The presence of summer low pressure systems over the interior, commonly referred to as heat lows, produces intense hot, dry conditions (Pringle et. al 1994).

### Rainfall

Rainfall is both irregular and highly variable across the district. The mean annual rainfall over the 80 year period (1939 – 2025) for Kalgoorlie Boulder Airport (BOM Station12038) is 265.2mm. Significant falls have been recorded during the summer period in some years resulting from ex-tropical lows/ cyclones moving over the region.

### Temperature

Mean daily annual maximum temperature for Kalgoorlie is 27.9ºC with the highest mean maximum for the month of January (33.7ºC) and the lowest mean maximum month being

July (16.8ºC). Minimum temperatures have also been above average for much of the year with the
exception of May to July.

**Humidity and Evaporation**

Mean annual 9am relative humidity is 50% at Kalgoorlie and 30% at 3pm. The mean daily evaporation rate is 6.85mm and the total average annual evaporation is 2,500mm (BOM Average Pan Evaporation -1975-2025) .

## *2.2 Landforms and Soils*

The regional landscapes in the Siberia district are generally of undulating, low relief and characterised by internally draining saline drainages and playa lakes occupying broad alluvial valleys between erosional highs. The relief of outcrop areas is closely related to underlying geology with granitoids forming eroded pavements and domes, and basalts and metasedimentary rocks forming elongated, rounded hills and strike ridges.

The topography of the project area is generally subdued, with elevations ranging between about 450 m AHD and 480 m AHD. The main landforms include: undulating relief of 6 m to 30 m, denudational plains with relief of less than 15 m and depositional plains with relief of less than 15 m. Landforms in the mine areas are described using the land systems approach defined by Pringle et. al. (1994) with the mining operations influenced by 3 primary surrounding Land Systems – Morairty, Marmion and Doney.

The predominant soil-landform association in the project area is described as Unit 265 (Kambalda zone) in the WA Department of Agriculture rangelands classification system (Tille 2006). The dominant landform the System are flat to undulating plains (with hills, ranges and some salt lakes and stony plains) on greenstone and granitic rocks of the Yilgarn Craton. Dominant soil types consist of calcareous loamy earths and red loamy earths with salt lakes soils and some red-brown hardpan with shallow loams and red sandy duplexes.

## *2.3 Water Resources*

Water resources in the Siberia District can be described in terms of ephemeral surface waters and deeper groundwaters of varying quality and salinity.

### *2.3.1 Groundwater*

The SGO project area lies on the Kalgoorlie Hydrogeological Series (SH51-9) 1:250,000 scale map sheet. Historically, water abstraction for mining and mineral processing in the Davyhurst and Sand King area has drawn upon the aquifers underlying the Sand King Borefield and the palaeochannel aquifers underlying the Battery Dam Borefield to the north. Limited yield fractured rock aquifers due occur in the mine environment within rocks primarily where tectonic action and weathering has created zones of secondary permeability.

The Sand King Borefield is underlain by two aquifers, the lower and upper. The lower aquifer consists of semi-consolidated fine to coarse angular quartz sands and sandy clay overlying oxidised granite. The upper aquifer comprises fairly homogenous siliceous magnesite and carbonate, with poorly developed sandy lenses. Overlying the upper aquifer is a clay unit consisting of puggy clay, chert, minor sand lenses and ironstone. The clay unit is overlain by approximately 10 m of alluvial sand and soil. The bores installed as

part of the Sand King Borefield are established and will be utilized for longer term mine water uses, following exhaustion of the limited volumes of stored pit water.

Rockwater (2026) described the groundwater in the area as predominantly hyper saline (>30,000 mg/L TDS), ranging between about 30,000 and 170,000mg/L TDS. Salinity generally increases in a northerly direction. No groundwater dependent ecosystems have been recorded in the Project area.

### *2.3.2 Surface Drainage*

The SGO project area is characterised by two north-south trending drainage divides, the more eastern of which passes through the Sand King and Missouri open pits (refer to the surface hydrology Figure 4). Surface runoff in the project area generally flows via ephemeral streams and tributaries into large, low-lying flood plains and eventually into Wangine Lake, some 12 km west of the Sand King borefield, or into other smaller low-lying depressions in the area Aqua Terra (2003). There are no permanent water courses or other surface water features in the immediate project area. Stream flow occurs only after heavy storms or after persistent low intensity rainfall.

### *2.3.3 Potential Impacts*

Land management assessment for the Moriarty and Greaves Land Systems highlight that Footslope and Alluvial Plains terrain units are susceptible to water erosion where perennial shrub cover is substantially reduced (Payne et. al. 1998), or the soil mantle surface is extensively disturbed. While both of these activities will be undertaken as part of the mine establishment, management practices can substantially reduce the risks of environmental harm.

The primary objective is to minimise soil erosion and dust generation and limit the export of material into ephemeral drainage lines and onto verge vegetation. The following strategies will be implemented to achieve the clearing and rehabilitation objectives:

- Identify areas of major erosion hazard and avoid disturbance of these areas wherever possible;
- Provide environmental supervision and co-ordination of work teams during clearing and topsoil recovery;
- Minimise ground disturbance and restrict clearing to designated areas;
- Reinstate creek, any drainage line disturbance at the completion of any earthworks programme
- Schedule any ephemeral creek-crossing construction activities to coincide with no creek flow periods, where practicable;
- Return stripped topsoil and rootstock to the original horizon to promote rapid revegetation and surface stabilisation;
- Keep topsoil stockpiles out of inappropriate areas such as watercourses and areas subject to wetting by poorer quality waters;
- Control access and prevent vehicular movements over topsoil stockpiles;
- Rehabilitate progressively where required and re-spread cleared vegetation selectively to create habitats;
- Reform access roads to similar pre-construction surface conditions, and
- Install erosion control structures along roads and areas of high erosion risk.

The following strategies will be implemented to achieve dust minimisation:

- Minimise clearing and avoid unnecessary machinery movements,;
- Rehabilitate and/or stabilise disturbed surfaces as soon as possible, and
- Damp down with water of suitable quality from water trucks as necessary.

Historical evidence from exploration and mining activities in these areas from the 1980's to the present day suggests that no significant impacts to offsite drainage systems or water quality have occurred. Standard management control arrangements during clearing will keep impacts to an acceptable level.

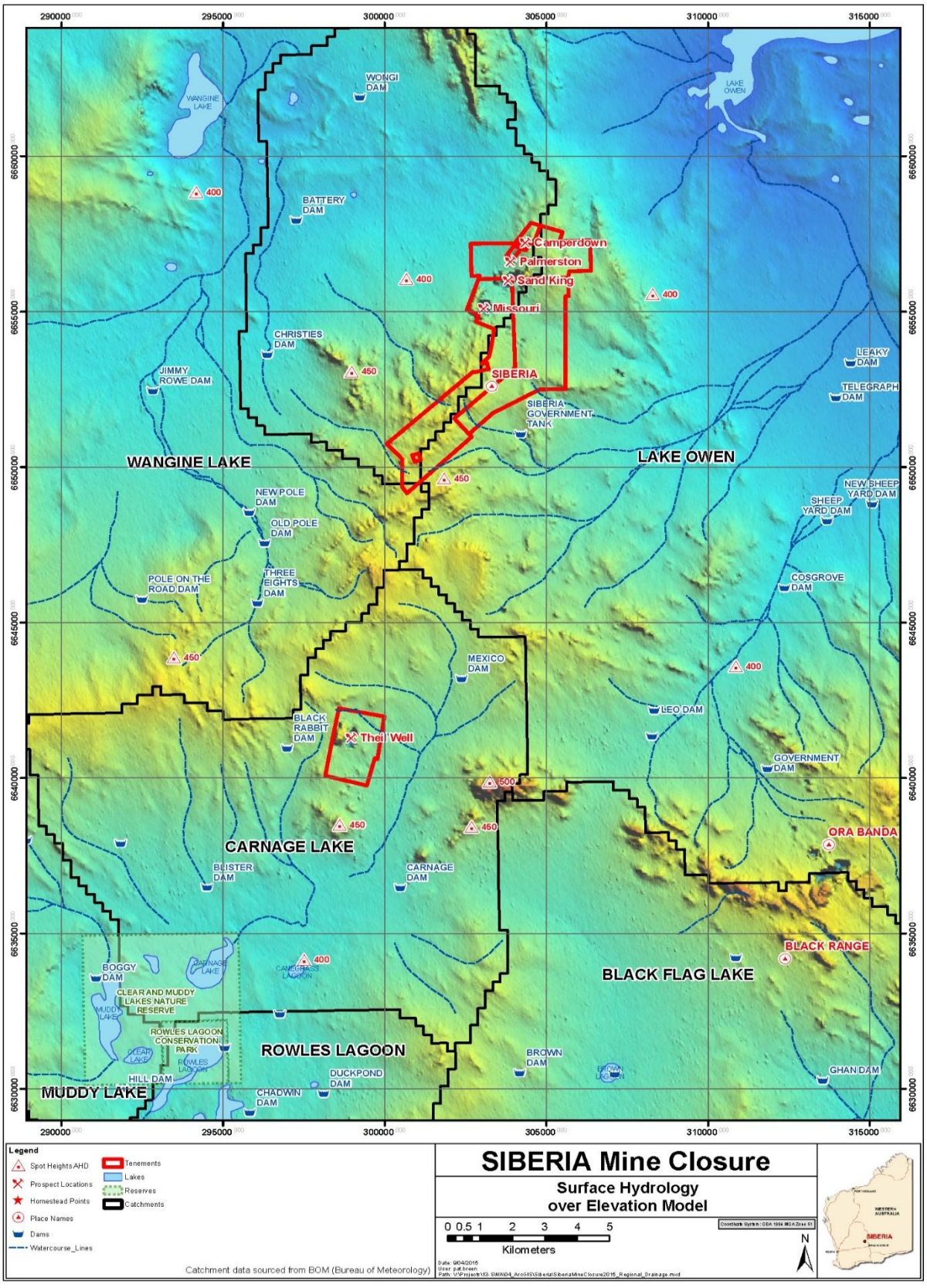



**Figure 3: Siberia Gold Operation – Surface Hydrology over Elevation Model**

## 2.4 Flora and Fauna

Pre-European mapping of the SGO area places it within the Eremaean Province in Beard Vegetation Association 468 – medium woodland: salmon gum and Goldfields blackbutt (Beard 1978). The Interim Biogeographical Regionalisation for Australia (IBRA) (Thackway and Cresswell 1995) places the proposal on the eastern boundary of the Coolgardie Bioregion (COO-03), adjacent to the Murchison Bioregion (MUR -01) as described by Cowan (2001).

Four surveys have been undertaken previously in the Proposal area (Outback Ecology Services (OES) 2003 & 2007; G&G Environmental (GGE) 2007, Plant Ecology Consulting (PLEC 2015) and Borger (2017). Flora field surveys (JBBC 2019) and a targeted fauna survey (Biostat 2019) were commissioned to assist in developing plans for managing clearing and assisting in closure and rehabilitation planning. During the course of the botanical survey, any evidence of the presence of Malleefowl *(Leipoa ocellata)* was recorded as part of the survey programme.

### 2.4.1 Flora

The semi-arid environment of the Siberia mine project area consists principally of open eucalypt woodland. Flora and fauna databases were consulted to determine the presence of declared rare species within the area and no threatened flora species were identified.

The Eastern Goldfields sub-region of the Coolgardie Bioregion is characterised as supporting diverse Eucalypt woodlands on low greenstone hills, valley floors, broad plains and salt lake surrounds; samphire shrublands on saline valley floors; and mallees, *Acacia* thickets and shrub-heaths on sand plains, playas, laterite areas and granite outcrops. Vegetation of the project area is also likely to be influenced by the East Murchison sub-region which lies less than 5km to the east.

The vegetation sub-group in which the majority of the Siberia tenements are located is a Eucalyptus over storey with a shrubby under storey. A total of seventy five taxa were recorded from 22 families of which 73 are native and 2 are weeds. *Nicotiana glauca** was present outside the proposal and has not been included in the records.

The most diverse families were Fabaceae (15 species from 3 genera (12 *Acacia*)); Chenopodiaceae (11 species from 7 genera); Scrophulariaceae (8 taxa from 1 genus – *Eremophila*); and Myrtaceae (5 species from 1 genus – *Eucalyptus*). Two sandalwood trees (*Santalum spicatum)*, a registered species) were recorded near quadrat Q4.

Groundcover was very sparse to isolated for much of the area, and many of the grasses had been grazed. Signs of cattle and donkeys were common in the woodland areas and a donkey was observed during the day. No evidence of Malleefowl were observed.

No Threatened Flora species pursuant to Schedule 1 of the *Biodiversity Conservation Act 2016* and as listed by the DBCA in December 2018 were recorded within the Siberia survey area. No Priority Flora species as listed by the DBCA 92018) were recorded within the survey area.

A total of two introduced (exotic) taxa were recorded within the Investigation Area. Of these, none are Declared Plants species pursuant to Section 37 of the *Agricultural and Related Resources Protection Act (1976)* according to the Western Australian Department of Primary Industries and Regional Development - Agriculture and Food Division listing within the Shire of Kalgoorlie Boulder.

No Threatened Ecological Communities as defined by the DBCA and the *EPBC Act (1999)* were recorded within the survey area. No Priority Ecological Community as listed by the DBCA (JBBC 2019) was recorded within survey area.

Current desktop and field survey evidence suggests no floral habitat of regional significance will be permanently impacted by the proposed recommencement of mining.

Recommendations in respect to the management of weed spread, minimisation of disturbance to natural runoff flow patterns, and confirmation of taxa suitable for use in minesite rehabilitation trials, were identified in the recent field work and these will be incorporated into the current revision of the Site Environmental Management Plan.

Recommendations in respect to the management of weed spread, minimisation of disturbance to natural runoff flow patterns, and confirmation of taxa suitable for use in minesite rehabilitation trials, were identified in the recent field work and these will be incorporated into the Site Environmental Management Plan.

### *2.4.2 Fauna*

The Project Area is located on Mt Burgess Station in the Coolgardie Bioregion. Biostat Pty Ltd (Biostat) were commissioned in October 2019 to undertake a desktop fauna study followed by a targeted search of the Siberia project area. The Survey consisted of (a) assessment of the fauna habitat characteristics of the Investigation area, (b) a preliminary determination of the quality of those habitats, (c) a discussion of the attributes of each of the species of conservation significance listed under the Federal and State government Acts, and (d) determination of the species likelihood of occurrence in each of the areas. The Biostat Report (2019) is referenced in Attachment B.

Plant communities were identified based on information provided in JBBC (2019).

A summary of the plant community types identified in the broader Siberia area includes:

**Table 1: Summary of Plant Community Types**

| Fauna Habitat Codes | Description | Fauna Habitat Condition | Area (ha) |
|---|---|---|---|
| EH | Eucalyptus woodland over shrubs on low stony/rocky hills | Degraded | 12.3 |
| EMH | Eucalyptus mallee over shrublands on low stony hills | Degraded | 21.1 |
| EP | Eucalyptus woodland over low shrubs on sheetwash plains | Degraded | 13.3 |
| MH | Mulga woodland on low stony hills | Degraded | 0.7 |
| D | Degraded/ cleared areas with some regrowth | Degraded | 4.7 |
| | | Grand Total | 52.1 |

The focus of this study was to investigate the likelihood of Mallee fowl (*Leipoa ocellata*) occurring in these areas and the value of the vegetation delineated for clearing to this species.

However, the investigations also required an assessment of habitats and their value to threatened fauna such as the (Curlew Sandpiper- *Calidris ferruginea)*, Night Parrot *(Pezoporus occidentalis),* Princess Parrot *(Polytelis alexandrae)* and the Chuditch *(Dasyurus geoffroii)* and the likelihood of occurrence of other threatened species in general.

**Malleefowl *(Leipoa occellata)*** is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) and Schedule 3 of the Western Australian *Biodiversity Conservation Act 2016* (*BC Act*). Pedestrian searches by the and Flora and Fauna survey team in November and December 2019, did not locate any evidence of their presence.

**Curlew Sandpiper- *Calidris ferruginea)***. Status - Critically Endangered. The Curlew Sandpiper is associated with coastal mudflat areas but can sometimes be observed at inland ephemeral lakes (fresh or saline). No near mine suitable habitat for this species was encountered during the minesite reconnaissance survey.

**Night Parrot (*Pezoporus occidentalis).*** Status - Endangered. The night parrot prefers areas of large spinifex hummocks in long unburnt grassland habitats. While spinifex grassland plains are encountered north of the minesite, these habitats consist of small clumping *Triodia* species rather than the large hummocks more commonly associated with Night Parrot habitat. The likelihood of this nomadic species being present in the Siberina PDA is ranked as low.

**Princess Parrot *(Polytelis alexandrae).*** Status – Vunerable. This species is restricted to the central arid interior of South Australia, Northern Territory and Western Australia. It is unlikely to be recorded in any of the project areas.

**Chuditch *(Dasyurus geoffroii)*.** Status – Vulnerable. Historical records exist from the eastern portion of the Greater Western Woodlands and Goldfields region. Much of the habitats that supported these species in the past has been highly modified or cleared. If they have persisted, the species is likely to be found in very low densities.

**Introduced Animals.** A total of five introduced mammals could potentially occur in the habitats of the mine Area; of most concern within the Coolgardie bioregion are the introduced herbivores; the european rabbit, feral goat, and donkey which have the most widespread impact on fauna habitats through grazing. Feral cats and foxes are present and these represent a threat to ground dwelling fauna.

A series of recommendations were provided in the Biostat (2019) report that will assist in minimising the impact on the habitats of a range of animals during clearing and mining operations at Siberia.

- Avoidance of unnecessary clearing of vegetation beyond that strictly required;
- Windrows of topsoil, log debris and leaf litter formed during clearing should be retained, as they create microhabitat for a large range of fauna, particularly reptiles.
- Rapid rehabilitation of cleared areas which are no longer required after construction.
- Rehabilitation should be structured to encourage the return of fauna by providing micro-relief and dense vegetation cover. This may be achieved, particularly in temporary laydown areas, by:
    - leaving patches or strips of vegetation and placing equipment on flattened shrubbery rather than clearing;

- retention of root stock in the ground by shallow scraping during essential clearing; and,
- Consideration is given to feral predator control (cat and fox) program.

Biostat (2019) concludes that none of the areas investigated are of sufficiently high quality and of importance to any of the listed threatened species for the area. In most cases, remnant habitats and areas are poor in quality and would not present a significant loss to the populations nor impact on local populations if they exist in the area.

## *2.5 CONSERVATION SIGNIFICANCE*

The significance of the biota of the Siberia area was assessed in three contexts – State, regional and local levels. As no Declared Rare Flora was recorded during field surveys, the proposed extension of mining areas has no significance at a State level. Of the fauna which could potentially occur in the region, Biostat identified 5 species of conservation significance, of which 3 have the potential to occur in the Siberia area. The Mallee fowl (*Leipoa ocellata*), Curlew Sandpiper (*Calidris ferruginea*), and Chuditch (*Dasyurus geoffroii)* are protected species under the Western Australian *Biodiversity Conservation Act (2016)*

Of the Scheduled species identified in the desktop study, all are in urgent need of conservation attention and Action Plans involving a range of conservation activities in conjunction with predator eradication are being managed by the DBCA with some success.

The presence of Schedule 1 fauna in the Siberia mine area, and remaining following the recommencement of mining, is considered highly unlikely, due to the lack of suitable habitat, a long history of land disturbance from grazing, timber cutting and mining, permanent night light exposure, continuous 24/7 noise and equipment movements. In respect to Malleefowl, their presence was not recorded at the Siberia project site during the recent botanical and fauna surveys (JBBC 2019; Biostat 2019) although they have been reported else wherein the District.

The LOM is of short duration (approximately 5 years) and the impact of clearing on small, regional fauna is expected to be minimal, with the eventual return of many terrestrial species back into disturbed areas after site decommissioning and rehabilitation. Threatening processes identified in the CALM Biodiversity Audit in 2002, included vegetation clearing and fragmentation, grazing pressure, feral animals (goats, foxes and cats), changed fire regimes, weed spread, salinity and mining. Management Plans to mitigate and manage those processes relevant to mining associated clearing will be developed and included in the current revision of the site EMP, and implemented as part of recommencement of mining.

A significant part of the proposed Siberia mine development is located within extensively disturbed historic disturbed areas and is part of a larger area degraded as a result of extensive past mining and pastoral activities. The site encompasses Land Systems and vegetation associations that are relatively widespread in the region (JBBC 2019). There is no evidence that floral habitat of regional significance will be significantly impacted by the proposed recommencement of mining operations.

The current proposal to expand the Siberia Gold Operations footprint will result in short term increase to site emissions and the disturbance footprint at the SGO site. Operational impacts can be managed through (a) minimisation of disturbance and clearing areas, (b) clearing only for annual waste rock disposal requirements and during seasonal time slots to minimize dusts, (c) avoiding changes to drainage patterns and sheet flow zones, (d)

controlling weed spread, (e) reducing impacts to soils and verges by using best quality ground water during dust suppression, and (f) progressive rehabilitation of disturbed areas during operations

## Table 2: Summary of Findings Against the 10 Clearing Principles

| No. | Principle / Assessment |
|---|---|
| 1 | **Clearing principle**<br>*Native vegetation should not be cleared if it comprises a high level of biological diversity.*<br><br>**Assessment:** Proposal is unlikely to be at variance with this principle<br><br>No Threatened or Priority flora were found during recent site surveys. The survey area does not fall within a Biodiversity Hotspot or area of outstanding biodiversity(JBBC 2019). The 73 taxa recorded from an area of 52 ha do not represent an unusually high degree of species richness for the area. It is likely that some annuals and grasses may have been absent due to adverse climatic conditions and grazing pressures. The Coolgardie IBRA region possesses a high floristic biodiversity, with a range of vegetation defining land systems (Cowan 2001). From a regional context, the 37 vascular plant species found within the survey do not seem significant, as these species are abundant throughout the broader area. Therefore, we do not consider that the proposed clearing is likely to be at variance with this principle. |
| 2 | **Clearing principle**<br>*Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.*<br><br>**Assessment:** Proposal is unlikely to be at variance with this principle<br><br>Vegetation communities within the project area are well represented within the broader region. Any fauna habitat occurring within the survey area is therefore well represented within the wider region. A desktop survey using the NatureMap (DBCA 2020) dataset shows that one threatened fauna species and one priority fauna species occur within 10 km of the survey area. The conservation significant fauna species' include:<br>The threatened species, *Leipoa ocellata* (Malleefowl) is listed as vulnerable by the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). *Leipoa ocellata* is found in semi-arid and arid, mallee and acacia shrublands (Benshemesh 2007) and could be present in the proposed development area. In Western Australia, this species is considered as Fauna that is rare or is likely to become extinct under Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2005. Loss and fragmentation of habitat are listed as major threats to both of these species. Although the proposed clearing areas comprise some of the described habitat types, pedestrian searches did not identify any evidence of Malleefowl presence .From a regional context, the vegetation complexes within the project area are well represented within the broader region.<br><br>Consequently, we do not consider that the proposed clearing is likely to be at variance with this principle |
| 3 | **Clearing Principle**<br>Native vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora.<br><br>**Not at variance with this principle**<br><br>No rare flora have been recorded from the proposed development area during surveys over a period of 15 years. No rare plants were recorded during the current 2019 survey. Many of the conservation listed flora within 30 km have been recorded from landforms or habitat not present within the proposed development area. |

| No. | Principle / Assessment |
|---|---|
| 4 | **Clearing principle**<br>*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.*<br><br>**Assessment:** Proposal is unlikely to be at variance with this principle<br><br>No plant assemblages representing threatened or priority ecological communities were recorded within the proposed development area. |
| 5 | **Clearing principle**<br>*Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.*<br><br>**Assessment:** Proposal is unlikely to be at variance with this principle<br><br>The surrounding region in which the proposal occurs has not been extensively cleared. The proposal is entirely within Vegetation Association 468: Medium woodland – Salmon gum and Goldfields blackbutt, which has 98.63 % (575,360 ha) of its mapped original extent (583,360 ha) remaining. Within the IBRA subregion Coolgardie – Eastern Goldfields 47,4364 ha (98.34 %) of the pre-European extent (482,361 ha) remains.<br>The area to be cleared is not considered to be significant as a remnant of native vegetation as the surrounding area has not been extensively cleared and the vegetation association is well represented outside the Project area. |
| 6 | **Clearing principle**<br>*Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.*<br><br>**Assessment:** Proposal is unlikely to be at variance with this principle<br><br>No watercourses or wetlands occur within the proposed mine development area. The proposed development area does not occur adjacent to or nearby to any major watercourse or wetland. |
| 7 | **Clearing principle**<br>*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.*<br><br>**Assessment:** Proposal is unlikely to be at variance with this principle<br><br>Two former Pastoral stations in the district are being managed as part of the Conservation estate: - Goongarrie National Park 50km to the east and Ex-Credo Station to the west is being managed as a Reserve. The latter contains the Clear and Muddy Lakes Nature Reserve(R7634) and Rowles Lagoon Conservation Park(R4274), approximately 30 km south of the mine development in an adjoining catchment. the clearing is unlikely to impact on the environmental values of any adjacent or nearby conservation areas. |

| No. | Principle / Assessment |
|---|---|
| 8 | **Clearing principle**<br>*Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation*<br><br>**Assessment:** Proposal is unlikely to be at variance with this principle<br><br>The Siberia area has a high level of mining and pastoral disturbance which has occurred over many decades. The minesite is located on the Mt Burgess Pastoral Lease which remains an active pastoral station. The current proposal which covers an area of 56.5 ha and includes areas which have already been historically disturbed and are not likely to contribute to appreciable new land degradation. Much of the area is flat to undulating and will pose a low erosion risk. Opportunities to enhance environmental biodiversity values through rehabilitation will be adopted. |
| 9 | **Clearing principle**<br>*Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface and underground water.*<br><br>**Assessment:** Proposal is unlikely to be at variance with this principle<br><br>Drainage in the area is ephemeral with surface water present for limited times during the year. Limited yield fractured rock aquifers do occur in the mine environment within rocks primarily where tectonic action and weathering has created zones of secondary permeability. Groundwater in the mine environs are confined to fractured rock aquifers, are typically saline to hypersaline er saline (>30,000 mg/L TDS), and have limited beneficial uses. |
| 10 | **Clearing principle**<br>*Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.*<br><br>**Assessment:** Proposal is unlikely to be at variance with this principle<br><br>Rainfall is typically greatest in winter months within the Eastern Goldfields and surface sheet flow only occurs after heavy storms or after persistent low intensity rainfall. The SGO project area is elevated and characterised by two north-south trending drainage divides, the more eastern of which passes through the Sand King and Missouri open pits. There are no permanent major watercourses or other surface water features in the Siberia mine area with the potential for flooding, and due to the limited size of the proposed disturbance area, and the presence of built mine infrastructure, the incidence or intensity of increased flooding is limited. |

# 4. SENSITIVE ENVIRONMENTAL RECEPTORS

This section provides details of any sensitive (environmental or social) receptors potentially impacted by the open pit cutback and underground mining proposal at the Siberia Project.

The Mt Burgess Pastoral Lease is owned and operated by Northern Star Resources and is an active pastoral property. The lease hosts a number of active exploration, prospecting and mining operations and the Resident Station Manager is kept informed of developments.

## *4.1 Heritage, Community and Consultation*

Searches of the Department of Planning, Land and Heritage online Aboriginal Heritage Inquiry System(AHIS) - Site Register for the relevant tenure - M24/960, M24/39, M24/208 and L24/224 and within the Shire of Kalgoorlie Boulder Local Government boundary have identified no sites within the proposed Siberia mining areas.

As part of the mining operations at SGO, OBM have completed a range of community and regulatory consultation programmes. These have included correspondence and presentations to the Department of Biodiversity, Conservation and Attractions (Kalgoorlie), Department of Mines Industry Regulation and Safety (DMIRS – Perth, Kalgoorlie), Department of Water and Environmental Regulation (DWER - Perth) and Native Title Claimant Groups. Discussions have also been held with local government – Shire of Menzies and Shire of Kalgoorlie Boulder and Local Pastoralists. This process will continue.

### *European Cultural Heritage*

There are no expected impacts on areas of significance to european cultural heritage within the proposed mining areas.

### Weed Management

Several well known weed species have shown themselves to be well adapted to colonisation of disturbed ground in the Eastern Goldfields. No noxious weed species were identified during the recent site inspection of the proposed Project Development areas (Borger 2017, JBBC 2019) although 2 common Goldfields environmental weeds were recorded in the mine environments. Operational management strategies adopted to stop weed spread include:

- Materials (i.e. soil) should not be removed from sites for reuse where weed infestations are evident without prior spraying;
- Require as a Site condition that all earthmoving equipment and vehicles are washed down prior to the initial transport to site and are soil free;
- Existing infestations in the general project area and stockpiles will be brought to the attention of the Mine Management for action;
- Undertake progressive rehabilitation of disturbed areas, (where feasible) to assist in reducing weed spread by promoting competition from local native species, and;
- Mine personnel are made aware of weed issues through the Site Induction Programme.

### *4.2 Land Discharge*

There is a minimal risk for liquid waste such as hydrocarbons to enter the environment during land clearing and stockpiling operations. Servicing of earth moving equipment will only be permitted in designated areas.

### 4.3 *Closure and Rehabilitation Management*

The Australian and New Zealand Minerals and Energy Council and the Minerals Council of Australia have jointly produced a framework for the development of Closure Plans. The Siberia Gold Operations Mine Closure Plan was approved by DMIRS in May 2025 and mine closure aspects arising from the proposed development will continue to be managed and reported through the Project AER.

The MCP guidelines recommend that final mine rehabilitation and decommissioning should ensure:

- That Stakeholders have their interests considered during the mine closure process and that the process of closure occurs in an orderly cost effective and timely manner;
- That the cost of closure is adequately represented in company accounts and the community is not left with a liability;
- There is clear transparent accountability and adequate resources for the implementation of the Closure Plan.
- The establishment of a set of indicators (i.e. completion criteria) that will demonstrate the successful completion of the closure process be developed prior to plan implementation, and
- That all statutory requirements are met.

### *4.4 Rehabilitation Concepts*

Rehabilitation is defined as the implementation of procedures resulting in the return of an area to a sustainable biological condition such that it does not require ongoing maintenance.

The primary objectives for the closure and rehabilitation of the Siberia Project Development Area and infrastructure are outlined below. These are:

- Ensure risks to public safety are minimised and that the community do not inherit any road closure liabilities;
- The site is returned to a condition that will support current land uses;
- Stable topographic conditions are established that will support, a self-sustaining indigenous vegetation community consistent with the Land System and final land use objectives;
- Minimise off site impacts by removing deleterious materials, controlling infiltration, erosion, sedimentation and the degradation of existing drainages;
- Employ rehabilitation methods that are technically effective and cost efficient, rely on standard and proven engineering practices that do not require ongoing maintenance to ensure performance;
- Ensure the protection and conservation during rehabilitation works of any identified elements of the cultural and conservation estate within the mining leases.

### *4.5 Temporary Care and Maintenance*

In the event of a Temporary Mine Closure, the transition from operations to Care and Maintenance status will be an orderly and managed process in accordance with the provisions of the approved Plan.

# 5. REFERENCES

Borger J (2017) *Level 1 Vegetation and Flora Survey of the Siberia Prospect*. Prepared for Eastern Goldfields Pty Ltd

Burbidge A.A., Keighery G.J., McKenzie N.L. (1995) *Records of the Western Australia Museum – Supplement 49. The Biological Survery of the Eastern Goldfields of Western Australia – Part 12 Barlee Menzies Study Area*

Bureau of Meteorology (2020) Climate Averages for Kalgoorlie Boulder web accessed November 2019, January 2020, www.bom.gov.au

Cowan M (2001) Coolgardie 3 (COO3 – Eastern Goldfields subregion) in May J E & McKenzie N L (eds) Biodiversity audit of Western Australia's 53 biogeographical subregions in 2002. Department of Conservation and Land Management, Perth WA

Department of Biodiversity, Conservation and Attractions (2019a) List of Priority Ecological Communities endorsed by the Western Australian Minister for the Environment, DPaW Perth WA

Department of Biodiversity, Conservation and Attractions (2019b) List of Threatened Ecological Communities endorsed by the Western Australian Minister for the Environment, DPaW Perth WA

DBCA (2019). Florabase, the Western Australian Flora viewed November 21, 2019. http://florabase.calm.wa.au.

DWER (2019) NatureMap*: Mapping Western Australia's Biodiversity*. Department of Environment and Conservation. URL: *http://naturemap.dec.wa.gov.au/*

Gibson N and Langley M A (2012) Vascular flora of Credo Station and adjacent reserves. A report to the Bush Blitz Program, Australian Biological Resources Study. Department of Environment and Conservation, Perth WA

Outback Ecology (2007) Flora survey of Salmon Gums, Two Gums, Federal Flag, Walhalla, Golden Eagle, Makai, Sand King, Missouri and Lady Bountiful sites for Monarch Gold Mining Company Ltd: Davyhurst Gold Mine

Plant Ecology Consulting (2015) Siberia Mine, Davyhurst Flora and Vegetation Survey, Kingsley WA *for* Piacentini & Son (2016) – Level 1 Flora and Fauna Survey Siberia Minesite – Eastern Goldfields Ltd.

Pringle H J R, Van Vreeswyk A M E and Gilligan S A (1994) An inventory and condition survey of the north-eastern Goldfield, Western Australia. Department of Agriculture, Western Australia Technical Bulletin No. 87. Agriculture Western Australia, South Perth, W.A.

Thackway R and Cresswell I D (1995), *An Interim Biogeographic Regionalisation for Australia: a framework for establishing the national system of reserves, Version 7.0* Canberra: Australia Nature Conservation Agency

Department of Biodiversity, Conservation and Attractions (2019a) List of Priority Ecological Communities endorsed by the Western Australian Minister for the Environment, DPaW Perth WA

Siraz L (2008) Hydrogeological review for sourcing alternate groundwater supply – Riverina Pit *for* Monarch Gold Mining Company Limited. HydroSolutions Pty Ltd Willetton, Western Australia

Western Australian Herbarium (2019) *FloraBase – the Western Australian Flora*, accessed October 2019 and January 2020, URL *http://florabase.dbca.wa.gov.au*

# 6. DEFINITIONS

| | |
|---|---|
| Application Area | Area of proposed project native vegetation clearing including buffers zones as listed in the application form. |
| Care and maintenance | All mining operations suspended, site being maintained and monitored. Resident caretaker – considered Managed Care and Maintenance. |
| Disturbed | Area where vegetation has been cleared and/or topsoil (surface cover) removed. |
| Disturbance type | A feature created during mining or exploration activity, e.g. waste dumps, haul roads, access roads, ROM, plant site, TSF, borrow pits, drill pads, stockpiles, office blocks, accommodation village, etc |
| Investigation Area | Area of survey surrounding proposed development for baseline studies also called Environmental Survey Area - ESA. |
| Life of mine | Expected duration of mining and processing operations. |
| Orthophotography | Use of aerial photography to measure areas of disturbance. |
| Pits | All open excavations including active mineral rock, gravel, sand, clay, bauxite and salt-pan extraction areas. |
| Project | The total integrated mining operations in which a number of sites contribute to the overall operation to supply ore, processing facilities and disposal of waste products. |
| Preliminary earthworks | Reshaping, capping, water/wind erosion control, rock armouring. |
| Rehabilitated | Areas are safe, have demonstrated stability under representative climatic conditions, non-polluting and support a functioning, self sustaining ecosystem comprising local native species. |
| Relinquished | Agreed closure criteria met, government "sign-off" achieved, all obligations under the Mining Act removed and bonds retired. |
| Reporting period | Twelve month period from reporting month as specified in tenement conditions e.g. if reporting month is June, reporting period would be June – May. |
| Revegetation | Establishment of self sustaining vegetation cover after earthworks have been completed. |
| Tenement | Land tenure granted under the *Mining Act 1978* e.g. Mining Lease Exploration Licence, Prospecting Licence, Miscellaneous Licence, General Purpose Lease. |
| Waste landforms | Includes all mullock and waste rock disposal areas. |

# 7. ACRONYMS

| | |
|---|---|
| AER | Annual Environmental Report |
| AMD | Acid Mine Drainage |
| BOM | Bureau of Meteorology |
| CP | Clearing Permit |
| DBCA | Department of Biodiversity Conservations and Attractions |
| DWER | Department of Water and Environmental Regulation |
| DMIRS | Department of Mines Industry Regulation and Safety |
| DOW | Department of Water now incorporated in DWER |
| DSR | Drill Site Rehabilitation |
| Ec | Electrical Conductivity |
| EPA | Environmental Protection Authority |
| GLOS | Groundwater Licence Operating Strategy |
| GWL | 5C Groundwater Well Licence |
| LG | Low Grade |
| M | Mining Lease |
| mAHD | Metres above the Australian Height Datum |
| MCM | Managed Care and Maintenance |
| MOU | Memorandum of Understanding between EPA and DMP |
| OBM | Ora Banda Mining Ltd |
| OEPA | Office of Environmental Protection Authority |
| PEC | Plant Ecology Consulting |
| PWS | Parks and Wildlife Service |
| PAF | Potential Acid Forming |
| ROM | Run of Mine |
| SGO | Siberia Gold Operations |
| SMC | Siberia Mining Corporation Pty Ltd |
| SME | State Mining Engineer |
| SOM | Shire of Menzies |
| TDS | Total Dissolved Solids |
| TEC | Threatened Ecological Community |
| TSF | Tailings Storage Facility |
| WA | Western Australia |
| WCPL | Woolard Consulting Pty Ltd |
| WRL | Waste Rock Landform |
| SOA | Siberia Operations Area |

## Units of Measurement

| | |
|---|---|
| A | per annum |
| dS/m | deci Siemens per meter |
| g/t | grams per tonne |
| ha | hectare |
| kL | kilolitre |
| kt | kilotonnes |
| m | metre |
| mg/L | milligrams per litre |
| Mt | million tonnes |
| mbcm | million benched cubic meters |

# Attachment A

## Vegetation and Flora Survey
## Siberia Gold Operations - Project Development Area
## (JBBC 2019)

# Targeted Vegetation and Flora Survey of the Siberia Gold Operations Tenements M24/290 and M24/39

**November 2019**

**Ora Banda Mining Ltd,**

**Level 1, 2 Kings Park Road, WEST PERTH WA 6005**

**Jenny Borger Botanical Consulting**

**29 Andrew Street, Kalamunda WA 6076**

**E: jjborger1@westnet.com.au**

**Mobile: 0427 998 403**

**ABN 29 082 526 297**

## Executive Summary

The Siberia Mining Corporation Pty Ltd (SMC), a wholly owned subsidiary of Ora Banda Mining Ltd (OBM) proposes to recommence mining operations at the Siberia mine site in the vicinity of the historic Missouri and Sand King gold mines. The previous owner of the tenements, Eastern Goldfields Limited (EGS), commissioned flora and fauna surveys in 2015 (Piacentini & Son 2016; Plant Ecology Consulting 2015) prior to proposed mining activities. Jenny Borger Botanical Consulting (JBBC) was commissioned by EGS to establish analogue and rehabilitation monitoring sites in the Missouri and Sand King area in 2017 (JBBC 2017 unpublished). Following regulatory assessment in 2016/17, open pit mining briefly recommenced at both the Sand King and Missouri minesites following approval in January 2017. Mining and processing operations were suspended on the 3rd September 2018 and the site has remained in care and maintenance since that time.

Minor changes to the previously approved project description require updated flora and fauna surveys to support an amendment to the current Clearing Permit (6968/3) issued by the Department of Mining, Industry Regulation and Safety (DMIRS). The proposal area has been surveyed on three other occasions prior to 2015. No threatened or priority flora or ecological communities were identified during previous surveys.

OBM commissioned JBBC to undertake a flora and vegetation survey of the proposed development area (PDA) in 2019 covering an area of 52 ha between the former WMC (now decommissioned) TSF and the Missouri Open pit and smaller northern areas for infrastructure. Based on previous survey results and the current level of disturbances in a near mine environment, a targeted survey was deemed appropriate.

**The desktop assessment identified the following relevant aspects:**

- The proposal occurs on two soil map units BB5 and Mx43. BB5 consists of greenstone ranges and hills with shallow calcareous loamy soils, shallow brown and grey-brown calcareous earths. Mx43 consists of gently undulating valley plains and pediments with alkaline red earths with limestone nodules (calcrete) at shallow depths
- The proposal is mapped as pre-European Vegetation Association 468 – medium woodland: salmon gum and Goldfields blackbutt
- Based on Bureau of Meteorology records the overall interpretation of the climate in 2019 was warmer and drier than average
- 21 priority flora have been recorded within 20 km of the proposal, none have been recorded within the proposal area
- No threatened or priority ecological communities or environmentally sensitive areas are recorded near the proposal

**The field survey, conducted on the 3rd November 2019 identified the following:**

- A total of 73 native taxa from 22 families and 40 genera, and 2 weeds were recorded

- Six vegetation types were mapped ranging from *Eucalyptus* woodland, open woodland and open mallee woodland; and *Acacia* tall shrublands
- The vegetation condition was mostly good to very good
- Included in the scope of works was a requirement to report on the presence of mallee fowl (Leipoa occellata). No signs were observed in the Proposal area during the survey.

Assessment against DWER's 10 clearing principles indicates that none are at variance or likely to be at variance in relation to the proposed works.

The Siberia proposal was surveyed by Jenny Borger (botanist), Jeremy Shepherdson (ecologist) and Sam Rees (graduate ecologist). Borger and Shepherdson have a combined experience in Western Australian ecological/ botanical surveys of more than 40 years.

## Contents



**List of Appendices**

## List of Figures



## List of Tables

# 1. Introduction

## 1.1 Background

Orabanda Mining Ltd (OML) intends to recommence mining operations at the Siberia Project on tenements held by the Siberia Mining Corporation Pty Ltd (SMC), located in the Eastern Goldfields of Western Australia. The site has been in care and maintenance since 2018 when mining operations ceased when Eastern Goldfields Ltd (EGL) went into voluntary administration.

The mine complex is located 20 km north west of Orabanda, east of the Davyhurst – Orabanda Road (Figures 1 & 2) on unallocated crown land (UCL) within the boundary of Mt Burgess Station. The area to be impacted (the Project Development Area - PDA or Proposal) is mostly located on the south eastern side of the current disturbance area, between Sand King waste dump and Missouri pit and is adjacent to an existing haul road and administration area. Smaller infrastructure areas totalling 4.75 ha (Figure 8) are located around the Camperdown Pit and the proposed Contractor laydown. The Proposal is located within mining tenements M24/ 290, M24/ 39 and L24/224. A flora and vegetation assessment of the site is required for environmental impact assessment (EIA) under Part IV of the *Environmental Protection Act 1986* (EP Act). A Technical Guidance for Flora and Vegetation surveys for EIA was published by the EPA in 2016 under which a targeted survey was deemed appropriate to address the objectives of the survey (EPA 2016). The proposal covers an area of 53 ha, 48.25 ha of which occurs in the environmental survey area (ESA) of 52 ha (Figure 2).

The objectives of the survey were to:

- Undertake a desktop study of the PDA and surrounding areas;
- Undertake a pedestrian survey and Identify and describe the vegetation types present;
- Record the presence of any Threatened Ecological or Priority Ecological Communities (TEC, PEC);
- Record the presence of any threatened or priority conservation flora occurring in the area;
- Record the condition of the site and threats;
- Assess the proposal against the 10 clearing principles, and
- Observe and report on the presence of Malleefowl*(Leipoa occellata)*

## 1.2 Climate

The Eastern Goldfields region experiences a semi-arid climate with hot summers and cool winters and receives a mean annual rainfall of 266 mm at the Kalgoorlie Boulder Airport(KBA) - Bureau of Meteorology (BOM) Station 12038, 1939 – 2019). KBA is the closest monitoring station with long term data, and is located 70 km south east of the proposal. Rainfall has been recorded at Credo Station (BOM 012259) from 2011 – 2019; however this is not sufficiently long term to determine a long term mean. Monthly rainfall records for Credo and Kalgoorlie Boulder are presented in Table 1 and Figure 3 and show that rainfall is received throughout the year with no particular drier or wetter periods. Significant falls have been recorded during the summer period in some years resulting from ex-tropical lows/ cyclones moving over the region. Significant falls were recorded in October and November during 2018. Rainfall recorded for 2019 up to the time of survey (2$^{nd}$ November) show the region had a wet summer, average winter period and below average spring (August to October). December and August have been close to average for the last two years.

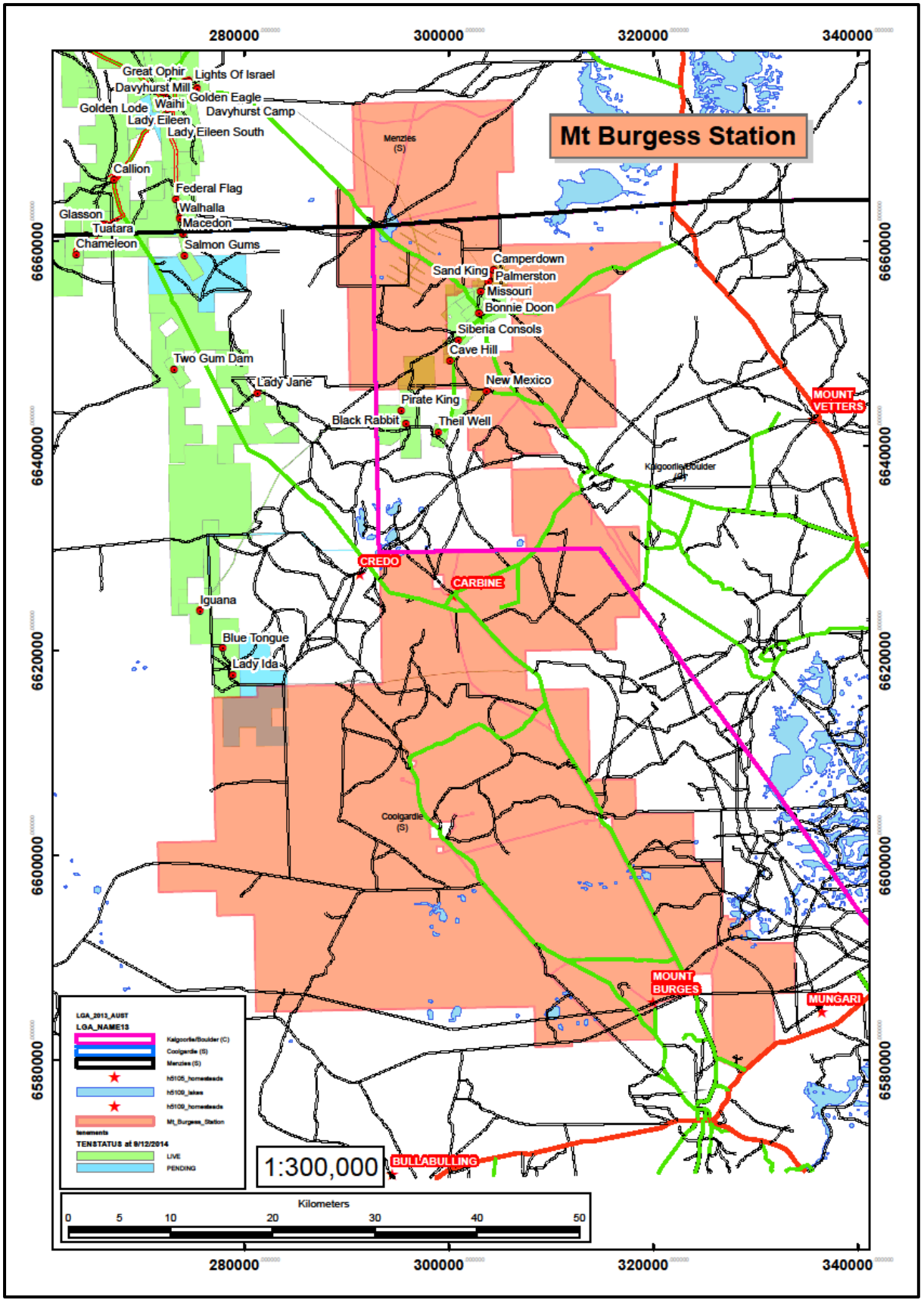



Figure 1: The Siberia Project is located 20 km NW of Ora Banda and 35 km SE of Davyhurst within the boundary of Mt Burgess Station.

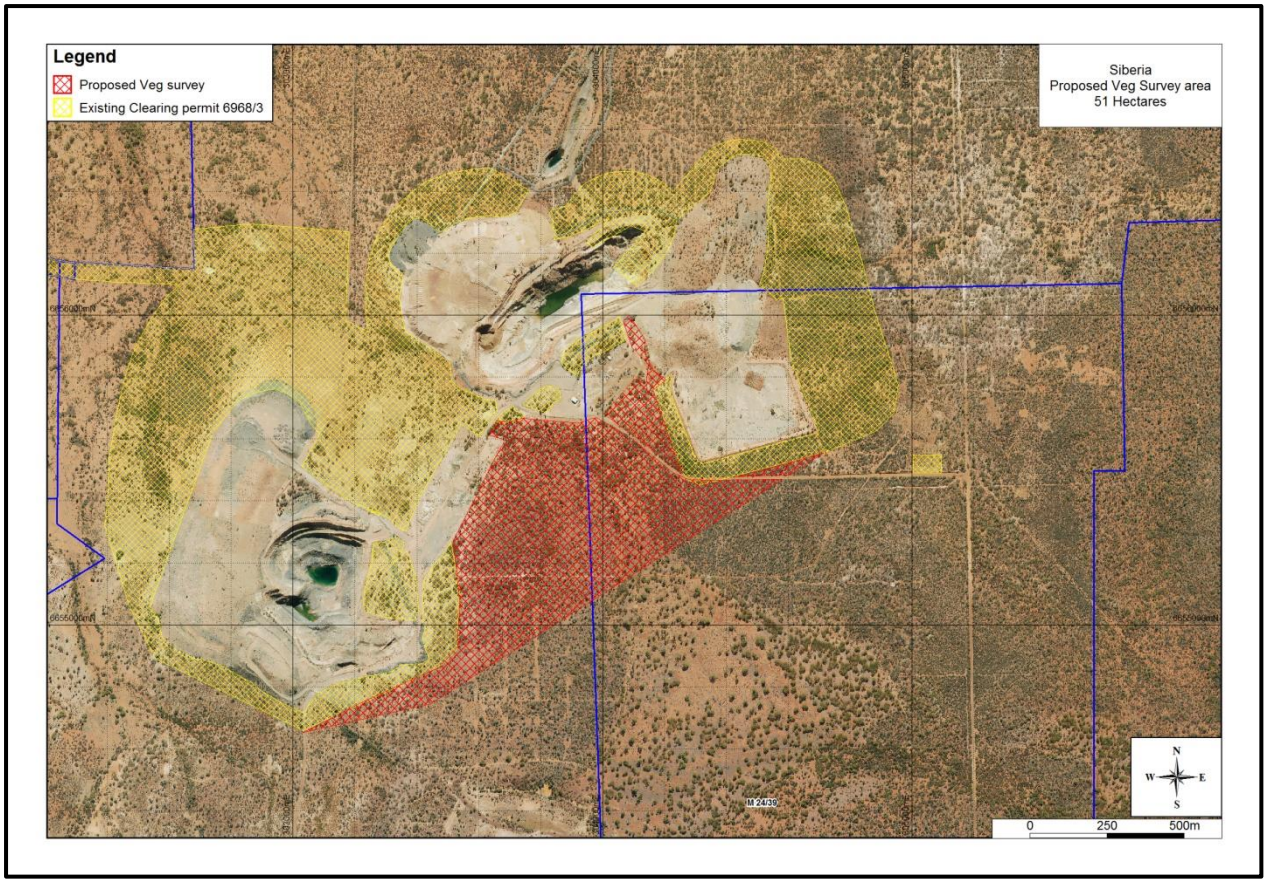



Figure 2: Siberia mining proposal environmental survey area. The Missouri pit is located west of the proposal (red highlighted area) and the Sand King waste dump is located on the NE side.

Table 1: Monthly rainfall data for Credo Station and Kalgoorlie Boulder (KB) Airport.

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KB Mean | 27.5 | 31.2 | 25.2 | 20.5 | 24.9 | 27.3 | 24.2 | 21.3 | 13.7 | 15.8 | 18.7 | 16.5 | 266.1 |
| Credo 2018 | 81.9 | 117.5 | 17.9 | 2.2 | 2.8 | 8.6 | 10* | 19.1 | 2.9 | 37.7 | 124 | 19.8 | 444.4* |
| Credo 2019 | 0.5 | 13 | 36.8 | 18.3 | 11.6 | 20.2 | 46.4 | 19 | 0.3 | 3.2 | 0.6 | 18.5 | 188.4 |
| KB 2018 | 45.4 | 65.2 | 7.4 | 11.4 | 1.2 | 11.6 | 7.8 | 29.8 | 2.8 | 68.8 | 62 | 14.4 | 327.8 |
| KB 2019 | 8 | 7.2 | 0 | 36.2 | 9.8 | 41.2 | 3.8 | 20.6 | 0.4 | 2.2 | 0.2 | 13.6 | 143.2 |

*Some data missing for July 2018

The highest maximum temperatures occur during the summer with the long term mean January temperature of 33.7$^{o}$C (Figure 4). The coolest month is July with a long term mean monthly maximum of 16.8$^{o}$C. The mean monthly maximum temperatures recorded during January to March 2019 were all above average, followed by a slightly cooler than average autumn and warmer than average winter/ spring period. Minimum temperatures have also been above average for much of the year with the exception of May to July. The overall interpretation of the climate in 2019 was warmer and drier than average.

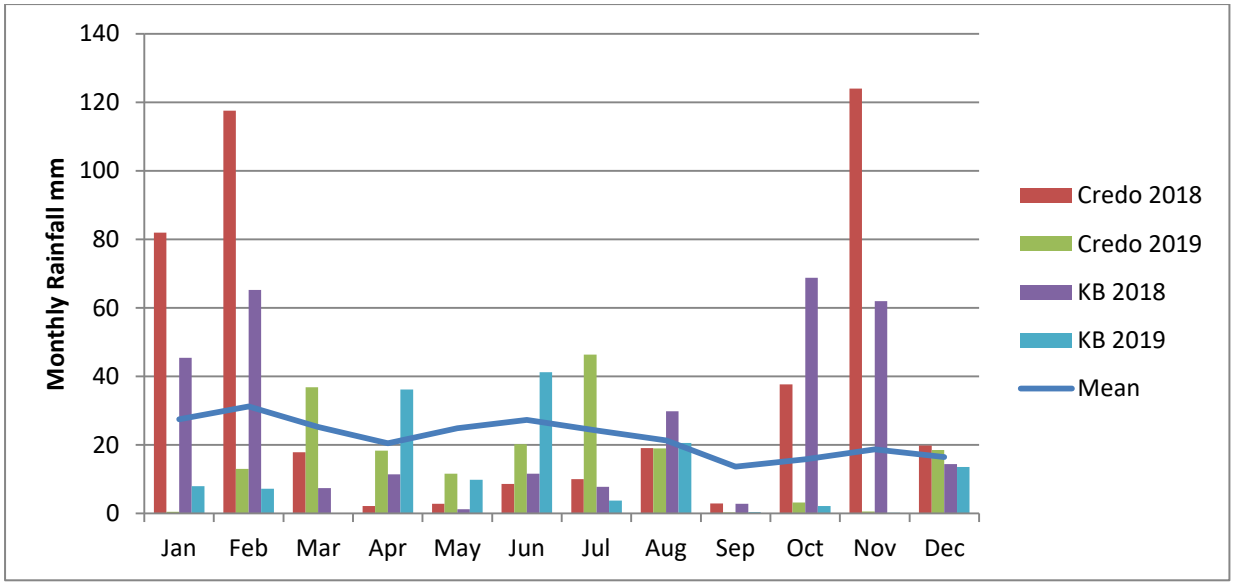



Figure 3: Monthly rainfall data for Kalgoorlie and Credo Station with the long term mean recorded at Kalgoorlie.

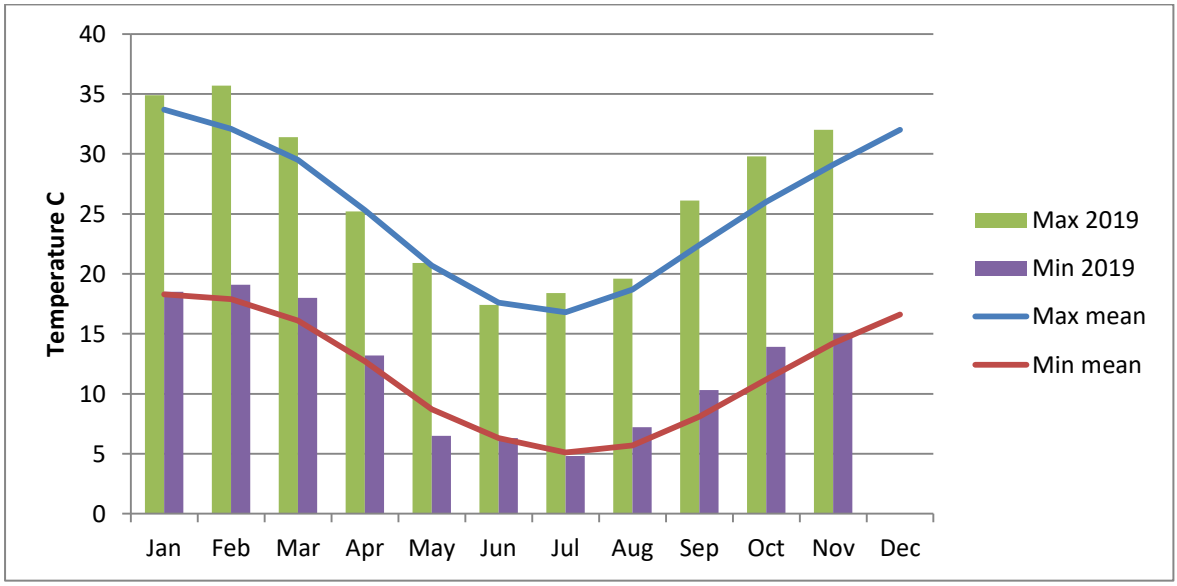



Figure 4: Mean monthly maxima and minima temperatures recorded at Kalgoorlie with the long term means.

### 1.3 Geology & Hydrology

Siberia lies within the Yilgarn Craton, east of the Ida Fault in the Kalgoorlie geological terrane. A number of mafic and ultramafic greenstone belts occur within the terrane and are composed of older Archaean basalts and komatiite units. Tertiary weathering has resulted in the presence of laterite in some areas. The proposal occurs on two soil map units BB5 and Mx43. BB5 consists of greenstone ranges and hills with shallow calcareous loamy soils, shallow brown and grey-brown calcareous earths. Mx43 consists of gently undulating valley plains and pediments with alkaline red earths with limestone nodules (calcrete) at shallow depths.

The proposal is located in the lower catchment and supports no major drainage lines. The area has been heavily disturbed as a result of past mining operations which may have changed some of the minor drainage aspects. Low hills are located on the eastern side, with one low hill having a laterite cap. A gently sloping valley is located between the hills.

### 1.4 Regional vegetation and condition

Pre-European mapping of the proposal area places it within the Eremaean Province in Beard Vegetation Association 468 – medium woodland: salmon gum and Goldfields blackbutt (Beard 1978). The Interim Biogeographical Regionalisation for Australia (IBRA) (Thackway and Cresswell 2017) places the proposal on the eastern boundary of the Coolgardie Bioregion (COO-03), adjacent to the Murchison Bioregion (MUR -01) which was described by Cowan (2001).

The Eastern Goldfields sub-region of the Coolgardie Bioregion is characterised as supporting diverse Eucalypt woodlands on low greenstone hills, valley floors, broad plains and salt lake surrounds; samphire shrublands on saline valley floors; and mallees, *Acacia* thickets and shrub-heaths on sand plains, playas, laterite areas and granite outcrops. Vegetation of the project area is also likely to be influenced by the East Murchison sub-region which lies less than 5km to the east. The East Murchison sub-region is characterised by elevated red desert sand plains, internal drainage and salt lake systems. Mulga woodlands (often with a rich ephemeral understorey), hummock grasslands, saltbush shrublands and samphire shrublands comprise the dominant vegetation units.

The region has been prospected and mined since the late 1890s which has impacted the vegetation through timber cutting (for mining and housing structures, and firewood) and clearing for mining, access tracks/ roads and towns. A pastoral industry was established from the early 1900's which has resulted in clearing, passive clearing, erosion and the introduction of weeds. The proposal is located within unallocated crown land (UCL) within the boundary of Mt Burgess Station (Figure 1), and Credo Station (ex-pastoral lease) is located to the west; however the area is subject to grazing and trampling by cattle, donkeys and rabbits which has resulted in the removal of grasses and forbs and likely impacted on recruitment and survival of tree and shrub species.

Meissner and Coppen (2013) undertook a survey of the flora and vegetation of the greenstone ranges occurring on Credo Station in 2011 from which six community groups were described. Sites 34 – 38, representative of community groups 2, 3 and 4, are located west of Siberia on mafic greenstone and ultramafic greenstone which are similar geology to the low hills at Siberia. The communities are described in Table 2 with updated species names. Communities 1 – 4 occurred on basalt geology, and 5 and 6 occurred on laterised or ironstone geology. *Senna artemisioides* subsp. *filifolia, Austrostipa nitida* and *Eriochiton sclerolaenoides* were all indicator species for communities 1 – 4.

Plant Ecology Consulting (PLEC 2015) were commissioned by Piacentini & Sons for EGS to undertake a flora and vegetation survey in the Siberia area in 2015 and described ten vegetation types (Table 3).

Results from the current survey will be compared against previous surveys to determine similarities between vegetation types over a broader area.

Table 2: Greenstone range communities described by Meissner & Coppen (2013).

| VC | Description |
|---|---|
| 1 | Open woodlands to open forest of *Eucalyptus oleosa* subsp. *oleosa, E. clelandiorum or E. dundasii* over open to sparse shrublands of *Eremophila* sp. Mt Jackson and *Senna artemisioides* subsp. *filifolia* over low sparse shrubland of *Ptilotus obovatus, Acacia erinacea* and *Olearia muelleri* or isolated *Roepera ovata*. Gentle or lower slopes of basalt hills. IS* = 0 |
| 2 | Open woodlands of either *Eucalyptus griffithsii* or *E. celastroides* over sparse shrubland of *Eremophila* sp. Mt Jackson and other *Eremophila* spp. (*E. interstans* subsp*. interstans or E. scoparia*), over low sparse shrubland of *Olearia muelleri*. Gentle slopes of basalt. IS = 0 |
| 3 | Open to sparse woodlands of *Casuarina pauper* or *Eucalyptus griffithsii* over shrubland to open shrubland of *Dodonaea lobulata, Eremophila oldfieldii* subsp. *angustifolia, Senna artemisioides* subsp. *filifolia and Scaevola spinescens* over open to sparse low shrublands of *Ptilotus obovatus*. Crests and slopes of basalt hills. IS: *Enchylaena tomentosa* |
| 4 | Open forests to open woodlands of *Eucalyptus* spp. (*E. clelandiorum, E. celastroides, E. griffithsii*) and occasional Casuarina pauper, over shrublands to sparse shrublands of Eremophila spp. (*E. oldfieldii, E. interstans* and *E. scoparia*), *Senna artemisioides* subsp. *filifolia* and *Dodonaea lobulata* over open to sparse low shrublands of *Acacia erinacea, Olearia muelleri* and *Ptilotus obovatus* and isolated *Roepera ovata* forbs. Slopes and crests of the basalt hills. IS = 0 |
| 5 | Open forest to open woodland of several dominant taxa *(Acacia burkittii, Allocasuarina eriochlamys, Grevillea oligomera, Eucalyptus oleosa*) over shrublands of to open shrublands of *Philotheca brucei* subsp. *brucei, Prostanthera grylloana* and *Dodonaea microzyga* subsp. *acrolobata*. Laterised basalt within the greenstone hills. IS = *Eremophila clarkei, Grevillea oligomera, Prostanthera grylloana, Allocasuarina eriochlamys* and *Dodonaea microzyga*; *Philotheca brucei* subsp*. brucei* and *Acacia burkittii* (Com. 5 & 6) |
| 6 | Either open tall shrubland or woodland of *Acacia burkittii* or *Allocasuarina dielsiana* over open to sparse shrublands of *Philotheca brucei* subsp. *brucei, Prostanthera althoferi* subsp. *althoferi* over sparse to isolated forbland or grassland of *Ptilotus helipteroides* and *Aristida contorta*. Ironstone geology. IS = *Cheilanthes sieberi* subsp. *sieberi; Philotheca brucei* subsp. *brucei* and *Acacia burkittii* (Com. 5 & 6) |

IS = Indicator species; no IS were confined to communities 1, 2 and 4.

Table 3: Vegetation types described by Plant Ecology Consulting (PLEC) in the proposal area (2015).

| Code | Description | Landform |
|---|---|---|
| Sc1 | *Acacia incurvaneura, A. mulganeura, A. ramulosa* var. *ramulosa* tall open shrubland | Red sandy loams on flats |
| Sc2 | *Acacia quadrimarginea* tall open shrubland over low open shrubland of *Dodonaea lobulata, Scaevola spinescens* and *Senna artemisioides* subsp*. filifolia* | Red loams on low stony rises |
| Sc3 | *Allocasuarina eriochlamys* subsp. *eriochlamys* open shrubland over open scrub of *Allocasurina eriochlamys* subsp. *eriochlamys, Alyxia buxifolia, Acacia ramulosa* var. *ramulosa* over *Dodonaea microzyga, Phebalium lepidotum, Philotheca brucei* subsp. *brucei* | Shallow red earths on ironstone outcrop |
| Sc4 | *Acacia acuminata, A. mulganeura, A. ramulosa* var. *ramulosa, Grevillea nematophylla* subsp. *supraplana, Eremophila ionantha, Prostanthera grylloana* closed scrub | Red sandy loam on flats |

Table 3 continued

| Code | Description | Landform |
|---|---|---|
| Sr1 | *Atriplex bunburyana, A. nummularia* subsp. *nummularia* and *Senna artemisioides* subsp. *filifolia* low open shrubland over *Sclerolaena diacantha, Eriochiton sclerolaenoides* with occasional *Casuarina obesa* and *Eucalyptus griffithsii* trees | Brown sandy loam on flats |
| Sr2 | Open shrubland of *Acacia hemiteles* with emergent *Casuarina obesa* and scattered groves of Eucalyptus spp. over low open shrubland of *Acacia erinacea, Eremophila scoparia* and *Senna artemisioides* subsp. *filifolia* | Red brown silty loams on broad flats |
| Sr3 | Shrubland of *Dodonaea lobulata, Scaevola spinescens* and *Senna artemisioides* subsp. *filifolia* over *Ptilotus obovatus* with emergent *Casuarina obesa* and *Eucalyptus salubris* | Red brown loams on low stony rises |
| Sr4 | High shrubland of *Acacia burkittii, A. incurvaneura* and *A. ramulosa* var. *ramulosa* | Red brown silty loams on flats |
| W1 | Low open woodland of *Eucalyptus griffithsii* over tall open shrubland of *Acacia burkittii, A. ramulosa* var. *ramulosa* over a low open hummock grassland of *Triodia scariosa* | Red brown sandy loam on flats |
| W2 | Low open woodland of *Eucalyptus lesouefii* over open shrubland of *Eremophila scoparia, E. ionantha* and *Dodonaea lobulata* over *Olearia muelleri* | Red brown loams on flats and simple slopes |

### 1.5 Conservation significant flora

Threatened, extinct and specially protected flora are species 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.*

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the 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 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 for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. The codes are described in Appendix 7. Conservation significant flora (threatened and priority) that may occur in the area are listed in Table 4 (NatureMap 2019; FloraBase 2019; Meissner & Coppen 2013; Gibson & Langley 2012).

Table 4: Threatened and priority taxa which have the potential to occur in the Siberia area.

| Taxon | Code | Habit and habitat | <20 km |
|---|---|---|---|
| *Calandrinia quartzitica* | P1 | Semi-erect to erect perennial herb; usually scrambling through other plants; grows on the edges of salt lakes | N |
| *Ptilotus chortophytus* | P1 | Erect perennial herb; yellow flowers; areas of dense quartz, disturbance areas; variety of vegetation types | N |
| *Ptilotus procumbens* | P1 | Spreading, procumbent annual herb; gravelly plain; broad flats; Red clay/ gravelly sandy loam; flowers Sept – Nov | N |
| *Ptilotus rigidus* | P1 | Rigid sub-spinescent shrub to 25 cm; associated with salt lakes | N |
| *Rhodanthe uniflora* | P1 | Herb; erect woolly annual herb; flowers yellow – Aug to Oct; open Eucalyptus woodlands | N |
| *Ricinocarpos* sp. Eastern Goldfields (A. Williams 3) | P1 | Shrub; 2 m high x 2 m wide. Flowers yellow. Rocky hillslope. Rocky surface. Red-brown sand-loam over felsic and mafic volcanics | Y |
| *Rumex crystallinus* | P2 | Annual herb; arid & semi-arid areas; very few collections; found at edge of Rowles Lagoon in ti-tree thicket | N |
| *Eucalyptus educta* | P2 | Mallee; straggly and spreading; minni-ritchi bark; granite hills | Y |
| *Austrostipa blackii* | P3 | Grass; tufted perennial | N |
| *Acacia eremophila var. variabilis* | P3 | Shrub; sandy or sandy loam soils; widespread | N |
| *Alyxia tetanifolia* | P3 | Shrub; sandy clay, loam, concretionary gravel; drainage lines; near lakes; flowers May to June, Nov | N |
| *Atriplex lindleyi* subsp. *conduplicata* | P3 | Short lived annual or perennial herb; crabhole plains; Rowles Lagoon | N |
| *Eleocharis papillosa* | P3 | Annual herb (rush); red clay over granite; claypans | N |
| *Eutaxia rubricarina* | P3 | Shrub; Variety of habitats, more commonly on flats and valley floors; recorded flowering August and October | N |
| *Homalocalyx grandiflorus* | P3 | Spreading shrub, pink – purple flowers (Oct – Dec) on yellow sand; sandplains | N |
| *Hysterobaeckea ochropetala subsp. cometes* | P3 | Erect shrub to 2 m high; flowers white; opposite leaves with pedicles up to half the length of the leaf blade; sandy soils in mallee over Acacia species with an understorey of spinifex | N |
| *Lepidium fasciculatum* | P3 | Erect annual herb to 60 cm, basal leaves pinnatisect to bipinnate with linear dentate lobes; isolated occurrences over wide area in WA; more common in eastern state; very few details on habitat | N |
| Notisia intonsa | P3 | Prostrate herb on red loam clays and associated with greenstone | Y |
| *Menkea draboides* | P3 | Herb; annual prostrate, spreading herb | N |
| *Philotheca coateana* | P3 | Shrub; pink – white flowers (Aug – Sep) on red sand | N |
| *Eucalyptus jutsonii* subsp. *jutsonii* | P4 | Mallee; 4 – 7 m high; bark rough over most stems; red to pale orange deep sands; undulating areas and on dunes | Y |

### 1.6 Threatened and priority ecological communities

Conservation significant plant communities are described as a naturally occurring assemblage of species which occurs in a particular type of habitat. A Threatened Ecological Community (TEC) is one that has declined in area or had a limited original distribution; is subject to processes which that threaten to destroy or significantly modify it across most of its range, and has been endorsed by the Environment Minister. A Priority Ecological Community (PEC) is one that is uncommon but do not meet criteria for TECs, or is inadequately defined. Searches of databases found no TECs or PECs are

likely to occur in the area and none were recorded in previous surveys of the proposal and adjacent areas.

# 2. Methods

## 2.1 Desktop survey

### 2.1.1 Previous surveys in the proposal area

Four surveys have been undertaken in the proposal area (Outback Ecology Services (OES) 2003 & 2007; G & G Environmental (GGE) 2007; and Plant Ecology Consulting (PLEC) 2015 for Piacentini & Son 2016). In 2003 OES recorded three structural vegetation types – Eucalypt woodlands, *Acacia* shrublands and *Casuarina* woodland which were divided into 13 associations and 77 taxa. An additional area adjacent to the Missouri and Sand King pits was surveyed in March 2007 which recorded 3 Eucalypt woodlands and an *Acacia* shrubland with 33 taxa. No conservation significant flora or vegetation were recorded.

GGE surveyed an area near Sand King pit in September 2007 which recorded one Eucalypt woodland and a mixed *Acacia* thicket with 28 taxa. In 2015 PLEC surveyed areas around Missouri and Sand King with some sites adjacent to the current proposal. Ten vegetation associations/ communities were mapped including low Eucalypt woodlands; *Acacia* dominated shrubland to *Allocasuarina* open scrub. Plant communities adjacent to the current proposal included W1: *Eucalyptus griffithsii* low open woodland with *Triodia scariosa* (south side of Sand King waste dump); W2: *Eucalyptus lesouefii* woodland (east of Missouri pit); Sc1: *Acacia incurvaneura* tall open shrubland; and Sc4: *Acacia incurvaneura, A. mulganeura* and *A. ramulosa* subsp. *ramulosa* tall open shrubland. A total of 88 taxa and 2 introduced species were recorded. No conservation significant flora or vegetation were recorded.

### 2.1.2 Limitations

Various factors can limit the effectiveness of a vegetation and flora survey. Seven potentially limiting factors have been identified in the Technical Guidance (EPA 2016) and are addressed in Table 5. The main limiting factors are related to disturbances and climate which are outside the control of the survey. The impact of a dry year is likely to have been exacerbated by pastoral activities.

Table 5: Survey limitations.

| Potential Limitation | Extent |
|---|---|
| Contextual information at a regional and local scale | Not limiting<br>The results of four surveys in or near the proposal area were available for study prior to the field survey. Regional surveys of the greenstone hills were undertaken by the Department of Parks and Wildlife in 2011 (Meissner and Coppen). Several other surveys within the region were also available. Species listed in Table 2 were researched prior to the survey with photographs taken of specimens at the Western Australian Herbarium, as well descriptions and imagery contained in published documents (Nuytsia Journal for example). |

Table 5 continued

| Potential Limitation | Extent |
|---|---|
| Competency/ experience | Not limiting<br>The survey team included a botanist and an ecologist who have undertaken surveying and monitoring work in the Ora Banda – Davyhurst area over several years, with at least 15 years' experience in vegetation surveys in the state. A recent graduate was employed to assist with the surveys and was given specific tasks to do which were within his capabilities, as well as training in identification and description of the vegetation. |
| Proportion of flora recorded and/ or collected, any identification issues | Partly limiting<br>The area was walked over with the three personnel 20 m apart and parallel. Annual species and grasses were mostly absent due climatic conditions and historical impacts from pastoral and feral grazers. Some grasses were present as grazed off tussocks which were not identifiable. Some perennial species were vegetative so identification was based on leaf/ phyllode and other characteristics. |
| Was the appropriate area fully surveyed | Not limiting<br>JBBC was provided with maps and GPS coordinates of the area which were referred to during the field survey. |
| Access restrictions within the survey area | Not limiting.<br>Vehicle access was available to the edge of the site on the north side. Several old exploration tracks and cleared areas were present within the proposal which allowed easy access to all areas of the site. |
| Survey timing, rainfall, season | Partly limiting<br>The timing of the survey towards the end of spring should have allowed most species to be present; however due to below average rainfall and warmer than normal temperatures most annuals were not present. Ground cover was usually less than 1 %. |
| Disturbance that may have affected the results such as fire, flood or clearing | Limiting<br>The area has been subject to multiple disturbances from mining and pastoral activities over several decades which have resulted in clearing and partial clearing as well as poor recruitment and survival. Some areas were in better condition than others. |

### 2.2 Field survey

The field survey was conducted by an experienced botanist (J Borger) and an ecologist (J Shepherdson) on the 2nd November 2019 with assistance from a new graduate (S. Rees). The site was searched on foot with sampling of the vegetation at appropriate points to record the species present. Four quadrats were established and described as well as a number of relevés. Changes in vegetation types were also recorded by GPS. Evidence for the presence for Malleefowl was noted during traverses.

Data from two quadrats established in February 2017 were also used (Borger; unpublished data for Eastern Goldfields Ltd). Conditions were wetter in 2017 and more annual species were present in the area. Most taxa were identified in the field. Specimens and photographs were taken of plants not verified in the field and identified using taxonomic keys and/ or compared against reference specimens at the WA Herbarium. Land surface information (soil type; litter, fallen timber, surface rock, cryptogam and bare ground cover) was recorded as well as threats and condition. The vegetation condition was rated according to categories described by Keighery and Trudgen (EPA 2016) and is presented in Table 6.

Table 6: Vegetation Condition (adapted from Keighery 1994 and Trudgen 1988; EPA 2016).

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

The vegetation was described based on floristic and structural information following the National Vegetation Information System (NVIS 2017) and Bushland survey methodology (Keighery 1994).

# 3. Results

## 3.1 Summary

Four quadrats were established during the survey and two existing quadrats established in 2017 were also included. Seven relevés were described plus opportunistic records were made of other finds, which often included disturbance species occurring along access tracks or other areas of more recent disturbance closer to the pits and waste dumps. A total of seventy five taxa were recorded from 22 families of which 73 are native and 2 are weeds. *Nicotiana glauca** was present outside the proposal and has not been included in the records. The most diverse families were Fabaceae (15 species from 3 genera (12 *Acacia*)); Chenopodiaceae (11 species from 7 genera); Scrophulariaceae (8 taxa from 1 genus – *Eremophila*); and Myrtaceae (5 species from 1 genus – *Eucalyptus*). No

threatened or priority taxa were recorded. Two sandalwood trees (*Santalum spicatum*, a registered species) were recorded near quadrat Q4. Groundcover was very sparse to isolated for much of the area, and many of the grasses had been grazed. Signs of cattle and donkeys were common in the woodland areas and a donkey was observed during the day. No evidence of Malleefowl were observed.

### 3.2 Vegetation types

#### 3.2.1 Vegetation type descriptions

Six vegetation types were identified from the survey which are summarised in Table 8 and mapped in Figure 6. No vegetation types are representative of TEC's or PEC's. Three vegetation types of Plant Ecology Consulting (PLEC; 2015) align with the current survey (SC1, SC4 and W1) (Table 7). W2 (*Eucalyptus lesouefii* woodland) is mapped as occurring adjacent to Unit 6 of the current survey but on lower slopes and outside the current proposal. The PLEC report also included results of Outback Ecology Services (OES) 2003 survey. Vegetation types were determined from the statistical analysis of species presence/ absence as well as structural and topographical features. VT1 is more representative of the Murchison bioregion. It is located within a few km of the boundary between the Coolgardie and Murchison bioregions. VT3 only occupies a small area of the proposal; however it is quite distinct from the other vegetation communities and the only location where *Philotheca brucei, Eremophila clarkei* and *Phebalium filifolium* were recorded. It had an extensive cover of rocks and boulders and was located on a crest.

Table 7: Comparison of vegetation types with previous surveys within the proposal area.

| JBBC 2019 | PLEC 2015 | OES 2003 mapping* |
|---|---|---|
| 1 | Sc1/ Sc4 | 1c/ 1d/ 2c |
| 2 | | 1c/ 3a |
| 3 | Sc3 - moderate | 1c |
| 4 | W1, SR2** | 1c |
| 5 | | 1e |
| 6 | Sr3 | 3a/ 1a |

* Described in Appendix 8

** Sr2 is possibly degraded W1

Site descriptions are presented in Appendices 3 and 4.

Table 8: Summary of vegetation descriptions for each of the vegetation types.

| Unit | Landform | Description | |
|---|---|---|---|
| 1 | Area: 21.1 ha | *Eucalyptus oleosa* isolated mallee over *Acacia caesaneura, A. incurvaneura* tall shrubland on low hills | |
| Low hill<br><br>Q2, R2, R2A, R3<br><br>PLEC – SC1/ SC4 | | *Eucalyptus oleosa* subsp. *oleosa isolated* mallee trees in *Acacia ramulosa* var. *ramulosa, A. caesaneura, A. incurvaneura, A. aneura, Grevillea nematophylla* subsp. *nematophylla, A. burkittii* tall shrubland/ low woodland over *Eremophila granitica, E. eriocalyx, Prostanthera grylloana, Grevillea didymobotrya subsp. didymobotrya, Dodonaea lobulata* open shrubland over *Eremophila granitica, E. eriocalyx, Prostanthera grylloana, Acacia ramulosa* var. *ramulosa, Scaevola spinescens, Dodonaea lobulata* low sparse shrubland over *Waitzia acuminata* low isolated forbs and low grass tussocks (dried off/ grazed) |  |
| 2 | Area: 7.1 ha | *Eucalyptus griffithsii, E. oleosa* low open mallee woodland over *Acacia* and *Grevillea* open shrubland on low hills | |
| Low hill; mid to upper slopes<br><br>R4, R6, R7 | | *Eucalyptus griffithsii, E. oleosa* low open mallee woodland (8 – 9 m)over *Acacia aneura, Grevillea nematophylla* subsp. *nematophylla, Casuarina pauper, Acacia ramulosa var. ramulosa* tall open shrubland (2 – 5 m) over *Acacia tetragonophylla, Grevillea nematophylla* subsp. *nematophylla, Scaevola spinescens, Dodonaea lobulata, Acacia aneura, Eremophila eriocalyx* open shrubland (1 – 2 m) over *Scaevola spinescens, Dodonaea lobulata* low sparse shrubland |  |

| Unit | Landform | Description | |
|---|---|---|---|
| 3 | Area: 0.7 ha | *Acacia aneura* shrubland over *Grevillea, Phebalium, Philotheca* and *Prostanthera* shrubland on rocky outcrop on hills | |
| Hill crest; rock outcrop<br>R5<br><br>DPAW Greenstone Community 5 | | *Acacia aneura* tall open shrubland (4 – 6 m) over *Grevillea nematophylla* subsp. *nematophylla, Phebalium filifolium, Philotheca brucei* subsp. *brucei, Exocarpos aphyllus, Prostanthera grylloana and Dodonaea lobulata, Eremophila clarkei* shrubland |  |
| 4 | Area: 11.2 ha | *Eucalyptus griffithsii* low open woodland over *Acacia and Grevillea tall open shrubland* on plains | |
| Plain<br><br>Q1, Q5<br><br>PLEC W1 | | *Eucalyptus griffithsii* and *Casuarina pauper* low open forest to open woodland over *Acacia caesaneura, Acacia hemiteles, Acacia colletioides, nematophylla* subsp. *nematophylla, Acacia burkittii* tall open shrubland over *Acacia hemiteles, Acacia burkittii, Senna artemisioides* subsp. *filifolia, A. ramulosa* var. *ramulosa, Eremophila scoparia, Dodonaea rigida, D. lobulata* open shrubland over *Acacia hemiteles, A. ramulosa* var. *ramulosa, Scaevola spinescens, Eremophila scoparia, A. colletioides, Senna artemisioides* subsp. *filifolia* low open shrubland over *Triodia scariosa* and *Austrostipa elegantissima* low isolated tussock grasses |  |

| Unit | Landform | Description | |
|---|---|---|---|
| 5 | Area: 2.06 ha | *Eucalyptus salmonophloia* open woodland over *Eremophila, Acacia* and *Exocarpos* sparse shrubland on plains | |
| Plain<br><br>Q3 | | *Eucalyptus salmonophloia* open woodland over *Eremophila interstans* subsp. *interstans* tall sparse shrubland over *Eremophila interstans* subsp. *interstans*, *Exocarpos aphyllus*, *Eremophila scoparia, Acacia hemiteles* sparse shrubland over *Acacia erinacea, Sclerolaena cuneata, Scaevola spinescens, Dissocarpus paradoxus*, *Sclerolaena diacantha* low sparse shrubland over *Roepera ovata* low isolated forbs |  |
| 6 | Area: 5.2 ha | Eucalyptus woodlands over Eremophila, Dodonaea and Acacia open to sparse shrublands on hills | |
| Hill<br><br>Q04, Q06<br><br>PLEC Sr3<br><br>DPAW Community 4 | | Q4: *Eucalyptus clelandiorum, E. griffithsii, E. salubris* woodland over *Eremophila* sp. Mt Jackson, *E. scoparia*, *Dodonaea lobulata, Senna artemisioides subsp. filifolia, Casuarina pauper, Exocarpos aphyllus, Acacia effusifolia, A. tetragonophylla, A. burkittii* open shrubland over *Eremophila* sp. Mt Jackson, *Casuarina pauper, Olearia muelleri, Scaevola spinescens, Dodonaea lobulata, Ptilotus obovatus* low open shrubland over *Austrostipa nitida, Roepera aurantiaca, Sclerolaena spp., Sida calyxhymenia* low isolated grass tussocks and forbs |  |
| D | Various areas<br>Area: 4.7 ha | Degraded/ cleared areas; some with regrowth or isolated trees or shrubs remaining | |

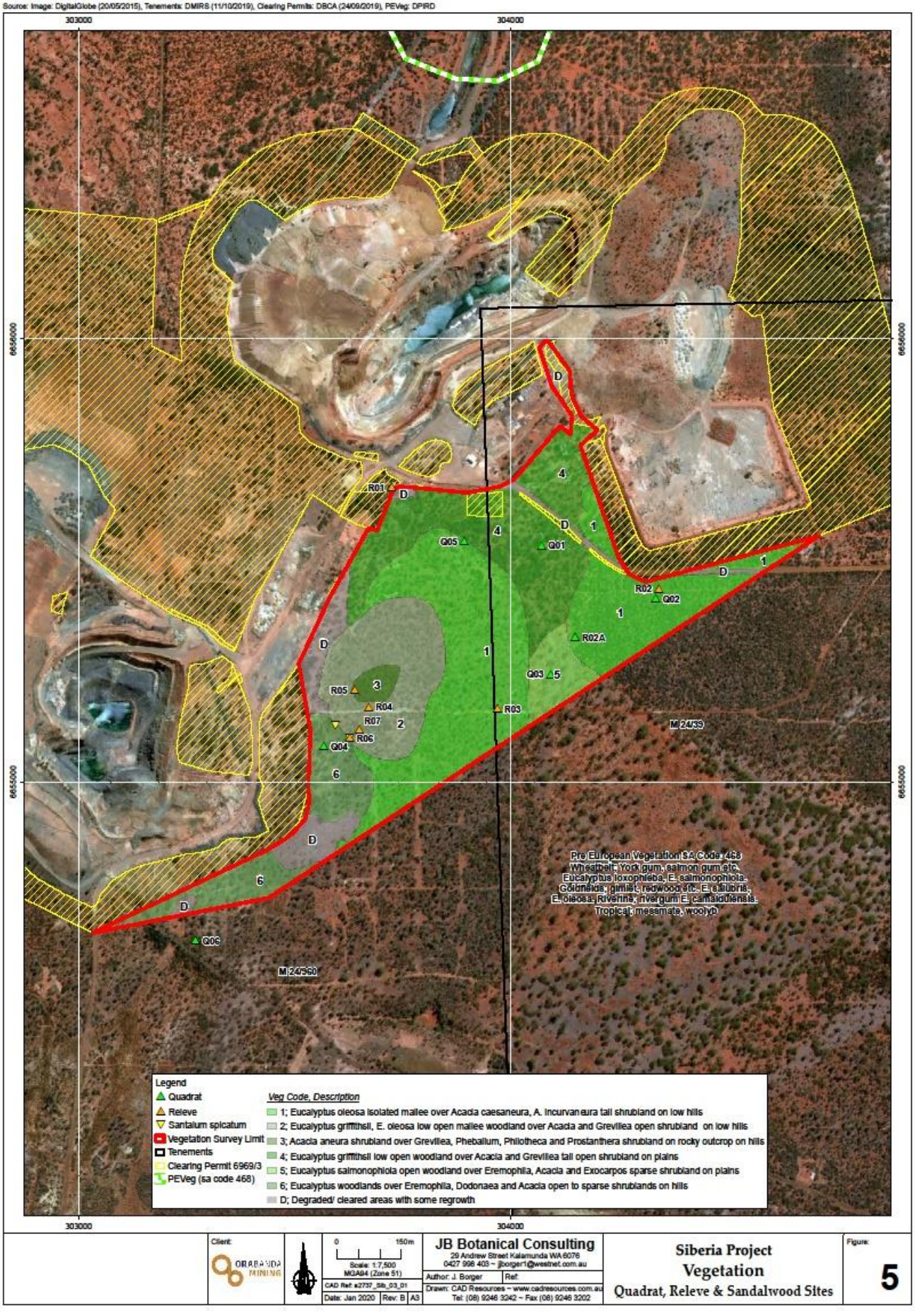



Figure 5: Vegetation mapping of the Siberia ESA

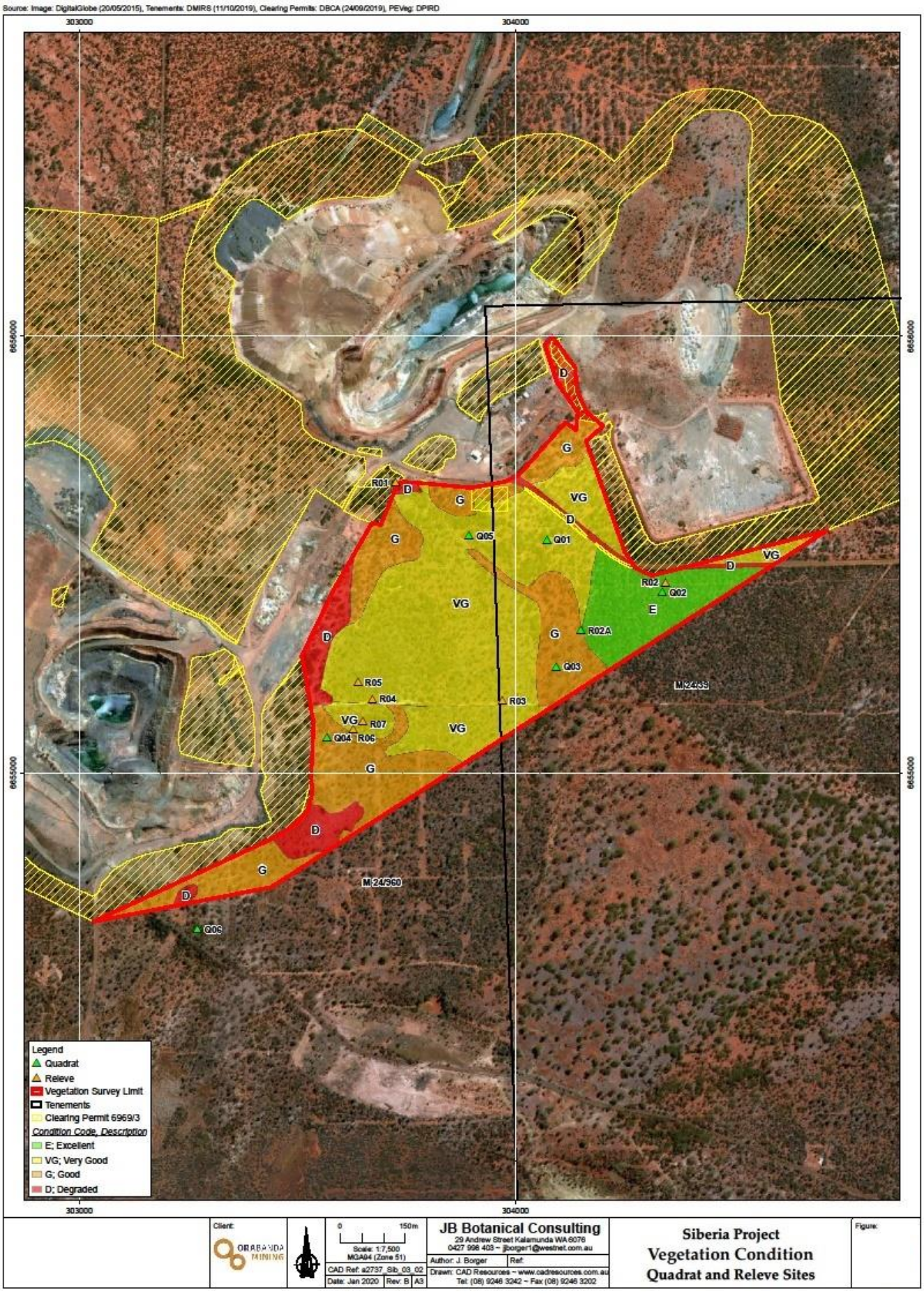
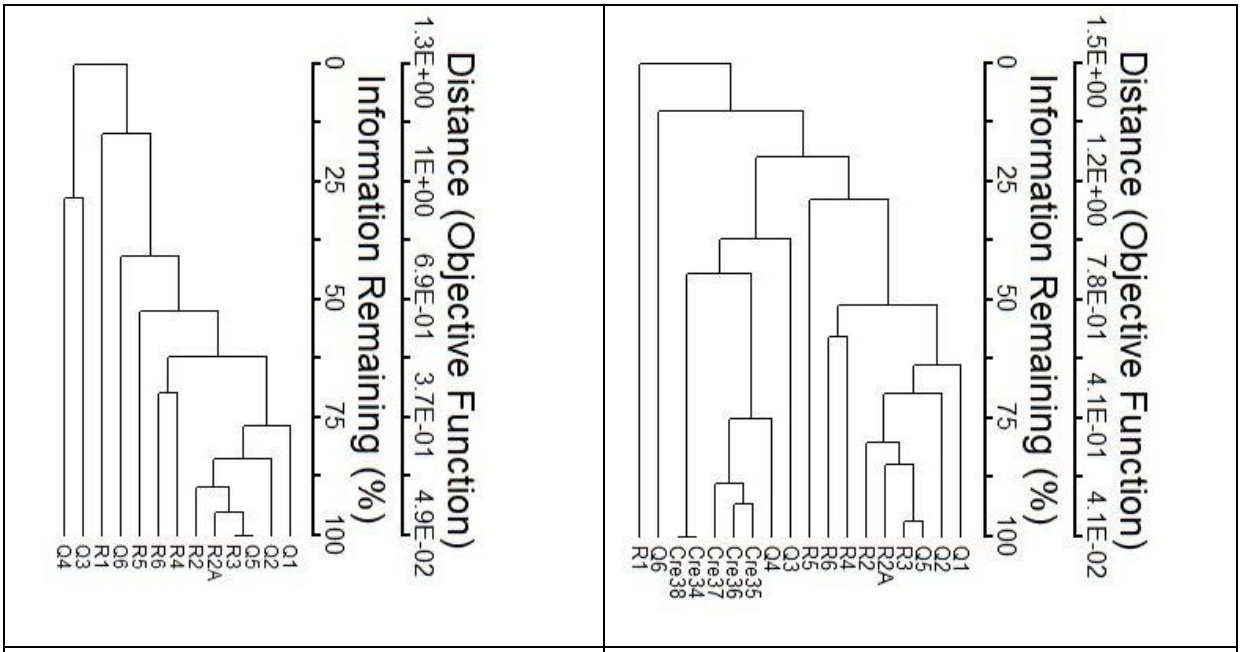



Figure 6: Vegetation condition of the Siberia ESA

### 3.2.2 Statistical Analysis

A two-way hierarchical cluster analysis was performed on species presence/ absence from the sites at Siberia, as well as against some Greenstone survey sites (Figure 7). Annual species were not included in the analysis as their occurrence is dependent on climatic conditions as well as grazing impacts and will vary between years. Q2, Q5, R3, R2, R2A and Q1 have a similarity > 75%. Q1 and Q5 were separated from the others for vegetation mapping as they are located on a plain, whereas the other sites are on low rises.

The Greenstone survey sites (Cre34 – 38) are located 14 to 16 km south west of the proposal with sites 34 and 35 on ultramafic greenstone, and 36, 37 and 38 on mafic greenstone. Siberia Q4 has a similarity within 75 % to Credo sites 35, 36 and 37 (Community 4 - open forests to open woodlands of *Eucalyptus* spp). Due to the high levels of impacts on some of the areas it is likely that some species are absent from the proposal area.




| Siberia sites only | Siberia and Greenstone survey sites |
|---|---|

Figure 7: Dendrograms produced from two way Bray-Curtis cluster analysis of the Siberia sites; and the Siberia sites against come of the DPAW Credo Greenstone survey sites. Siberia Q4 was statistically the closest to the Credo surveys.

### 3.3 Vegetation condition

Vegetation condition was rated from excellent (5.42 ha) to degraded (4.7 ha), with most areas rated as good (15.45 ha) or very good (26.46 ha) (Figure 6). The area around Q02 (VT1) was rated as excellent as all strata were present and current impacts were low. The area had historic mining impacts – old drill lines and pads – which were overgrown and no weeds were present in the area, and there was minimal impact from current cattle and donkey grazing. The woodland areas had the highest levels of impact and many signs were observed of cattle and donkeys.

## 4. Discussion

A total of 73 native taxa were recorded in the ESA over 52 hectares with Fabaceae (15), Chenopodiaceae (11), Scrophulariaceae (8) and Myrtaceae (5) being the most common families. PLEC (2015) surveyed 107 ha around Missouri and Sand King which recorded 88 native taxa with Fabaceae (18), Chenopodiaceae (12), Scrophulariaceae (10) and Myrtaceae (10) being the most common families. The results of the current survey are comparable with the PLEC survey. No threatened or priority taxa were recorded from either survey. The diversity of annuals and grasses was low which was expected due to climatic conditions and the levels of disturbances at the site.

The six vegetation types are consistent with previous surveys of the area, with the exception of VT3 which is similar to DEC greenstone ranges community 5 (Meissner & Coppen 2013). VT3 occurred on a laterite cap/ mafic greenstone which have a limited occurrence in the area being the remnants of weathered hills. No defined drainage lines were identified within the ESA. The vegetation communities are representative of the Coolgardie and Murchison regions which could be expected as the proposal is located very close to the mapped boundary.

An updated clearing proposal was received from OBM in March 2020 (Figure 8) which proposes to impact 53 ha on the southern side of the mining proposal, which includes 52 ha of the ESA and 1 ha under an existing clearing application CPA 6968/3. Two small areas (A & B) are also proposed on the northern side which were not surveyed. PLEC surveyed areas adjacent to site A which is described as Sr2 – *Acacia hemiteles* open shrubland (Figure 9).

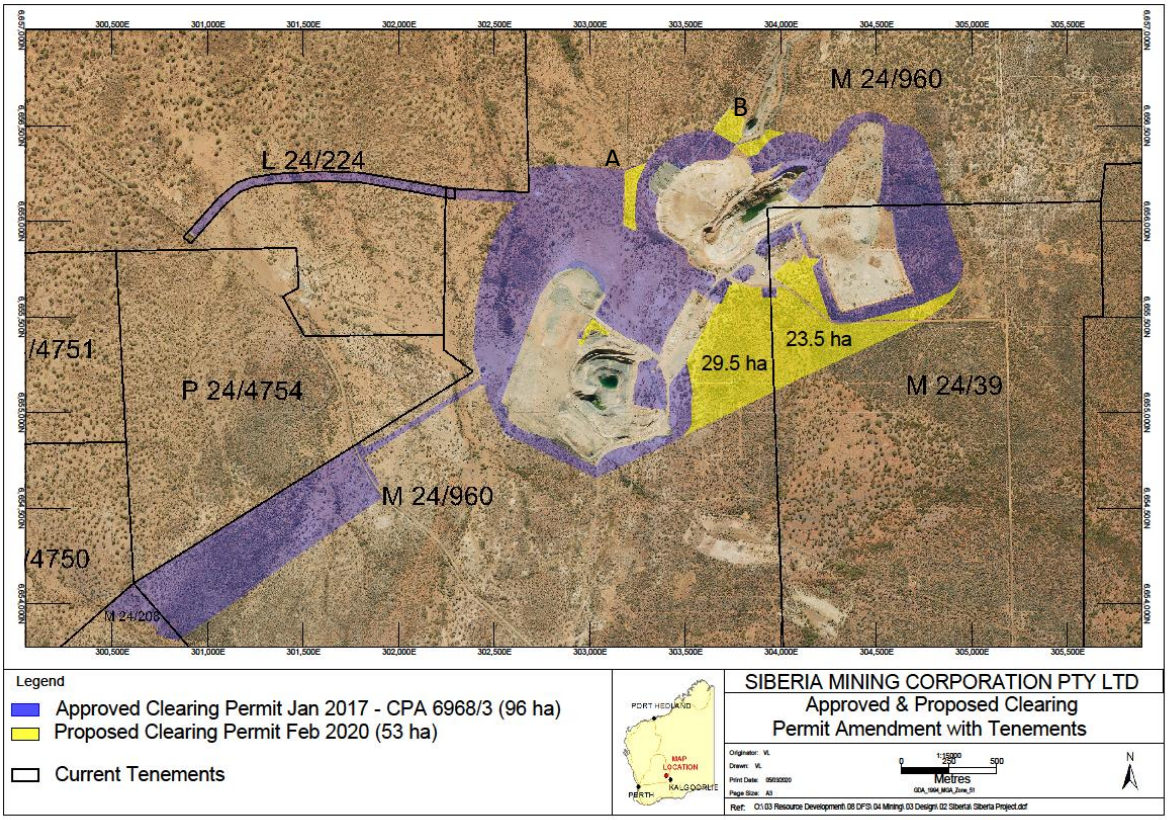



Figure 8: The proposed disturbance areas at Siberia (provided by SMC 2020).

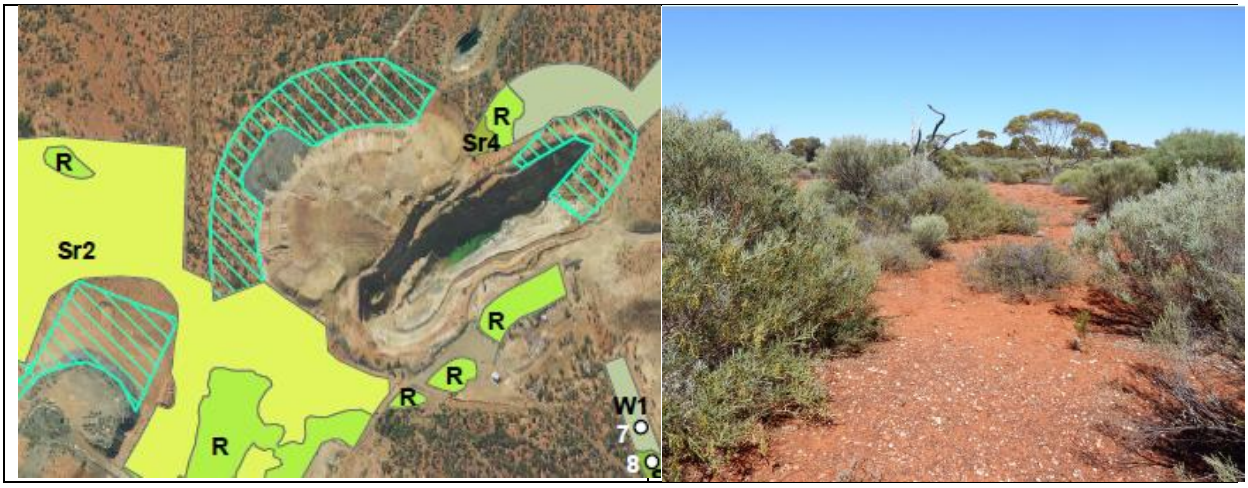



Figure 9: Vegetation mapping undertaken by PLEC in the northern area of the Siberia site. Site A is located adjacent to areas mapped as plant community SR2 and likely to support similar vegetation.

SR2 - Open shrubland of *Acacia hemiteles* with emergent *Casuarina obesa* and scattered groves of *Eucalyptus* spp. over low open shrubland of *Acacia erinacea, Eremophila scoparia* and *Senna artemisioides* subsp*. filifolia* which is possibly an impacted community close to VT4 of the current survey.


Figure 10: Vegetation mapping undertaken by OES (2007) on the western side of Sand King. Area B is located on the north side of western mapped area SE.

Area B is adjacent to mapping on the western side of Sand King which was surveyed by OES in March 2007 which was mapped as SE – Low *Eucalyptus oleosa* subsp. *oleosa* Woodland over Open Low Scrub A of *Acacia hemiteles, Dodonaea viscosa* subsp. *angustissima* and *Eremophila scoparia* over Open Low Scrub B of *Senna artemisioides* subsp. *filifolia* and *Acacia* sp. It is possibly representative of VT4 within the current ESA.

No conservation taxa were recorded in either survey of these areas, and it is highly unlikely that any will be present now.

The vegetation condition is close to what was recorded in previous surveys. The *Eucalyptus salmonophloia* woodland area extends further to the east from the site, and much of this has semi-mature stands of trees, indicative of either regrowth following a fire, or following a reduction in grazing impact and timber cutting. The understorey is in much better condition further away from the mining area as well. Weeds were sparse and mostly occurred at the edges of the area or on vehicle tracks which are still currently used. Groundcover (grasses and forbs) were very sparse or not present in much of the area which is likely to be a result of climate and pastoral impacts, including feral grazing. Surface erosion is occurring as sheet wash in some of the areas. No gully erosion was noted. The amount of fallen timber was lower than what would be expected pre-disturbance, thus impacting on potential fauna habitat and land surface protection. It is likely much of the timber would have been used during earlier mining activities for firewood.

*Nicotiana glauca** is present in the area west of the proposal and is likely to invade the area after disturbance. Control needs to be undertaken prior to and during the next phase of mining.

Proposed actions include:

- Weed control at the edges of the proposal and areas west of the site to reduce the likelihood of weed invasion
- Seed collection from the proposed clearing area prior to clearing if possible. This will be dependent on climatic conditions.
- Stockpiling of topsoil and plant material to be used for future rehabilitation
- Liaise with other stakeholders in the region (e.g. DBCA, Local Governments, mining companies, station owners/ leaseholders) to control feral animals – cattle, donkeys, camels and rabbits – to reduce the impact on vegetation and land surfaces.

A Native vegetation clearing permit will be required prior to any clearing and the proposal has been assessed the 10 clearing principles in Table 9.

## 5. Conclusions

The current survey supports findings from previous surveys and there were no range extensions, threatened or priority flora or ecological communities. Species diversity was also similar to earlier surveys. Grasses and annuals were very isolated due to climatic and pastoral effects. The proposed recommencement of mining operations at Siberia is highly unlikely to have a major impact on any vegetation community types or the environment as the condition of the site already has many impacts from previous mining and pastoral activities and the vegetation types are well represented in the region. SMC could take the opportunity to assist in future successful rehabilitation of the area by collecting and storing seed prior to commencement of the current project as well as by controlling weeds in surrounding areas so that there is less chance of invasion into an area which has quite a low weed burden at present.

Table 9: Assessment of the proposal against the Department of Water and Environmental Regulation's 10 clearing principles (EPA 1986)

| Clearing Principle | | Comment |
|---|---|---|
| 1 | Native vegetation should not be cleared if it comprises a high level of biological diversity. | **Proposal is unlikely to be at variance with this principle**<br>The 73 taxa recorded from an area of 52 ha do not represent an unusually high degree of species richness for the area. It is likely that some annuals and grasses may have been absent due to climatic and grazing pressures. |
| 2 | Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significant habitat for fauna indigenous to Western Australia. | **Proposal is unlikely to be at variance with this principle**<br>The vegetation types present in the area are not restricted to the proposal area, and none are representative of TEC or PEC assemblages. The regional extent of Beard's vegetation is still mostly intact; with > 98 % remaining. No mallee fowl or active mounds were located when walking through the area. Rainbow bee-eaters were recorded during the survey. The amount of fallen timber and litter is likely to be less than expected pre-disturbance (historical). This would impact to some degree on the value of the site as fauna habitat. One restricted landform was the laterite outcrop on the crest of the hill at R5. This is likely to provide habitat for ground dwelling fauna such as reptiles and insects. |
| 3 | Native vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora | **Not at variance with this principle**<br>No rare flora have been recorded from the proposal area during surveys over a period of 15 years. No rare plants were recorded during the current survey. Many of the conservation listed flora within 30 km have been recorded from landforms or habitat not present within the proposal. |
| 4 | Native vegetation should not be cleared if it compromises the whole or part of, or is necessary for the maintenance of a threatened ecological community | **Not at variance with this principle**<br><br>No plant assemblages representing threatened or priority ecological communities were recorded within the proposal. |
| 5 | Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared. | **Not at variance with this principle**<br><br>The region in which the proposal occurs has not been extensively cleared. The proposal is entirely within Vegetation Association 468: Medium woodland – Salmon gum and Goldfields blackbutt, which has 98.63 % (575,360 ha) of its mapped original extent (583,360 ha) remaining. Within the IBRA subregion Coolgardie – Eastern Goldfields 474364 ha (98.34 %) of the pre-European extent (482,361 ha) remains. |

Table 9 continued

| Clearing Principle | | Comment |
|---|---|---|
| 6 | Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland. | **Not at variance with this principle**<br><br>No watercourses or wetlands occur within the proposal. |
| 7 | 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. | **Not at variance with this principle**<br><br>Ex-Credo Station is being managed for conservation; however it is not formally recognised as a reserve at the moment. The nearest reserves are Clear and Muddy Lakes Nature Reserve and Rowles Lagoon Conservation Park, approximately 30 km south of the proposal. Ex-Credo Station covers an area of approximately 212,000 ha and includes the Clear and Muddy Lakes Nature Reserve (R7634) and Rowles Lagoon Conservation Park (R4274) within the boundary. |
| 8 | Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation | **Unlikely to be at variance with this principle**<br><br>The Siberia area has a high level of mining and pastoral disturbance which has occurred over many decades. The current proposal which covers an area of 53 ha which includes some areas which have already been disturbed and not likely to contribute to appreciable land degradation. Much of the area is flat to undulating and will pose a low erosion risk. |
| 9 | Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water. | **Unlikely to be at variance with this principle**<br>Drainage in the area is ephemeral with surface water present for limited times during the year. Groundwater in the mine environs are confined to fractured rock aquifers, are typically saline to hypersaline and have limited beneficial uses. |
| 10 | Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding. | **Unlikely to be at variance with this principle**<br><br>The proposal is located in the lower catchment area with low rises and plains and drains north into the mining area. The area would be subject to occasional flooding events most likely following high rainfall events associated with ex-tropical depressions during the summer period. It is unlikely that the land clearing associated with the proposal would increase the incidence of flooding. |

## 6. References


Brooker M I H and Kleinig D A (1990): Field Guide to Eucalypts – South-western and Southern Australia. Inkata Press Pty Ltd Melbourne and Sydney

Brown A and Buirchell B (2011) A Field Guide to the Eremophilas of Western Australia. Published by Simon Nevill Publications, snpub@bigpond.net.au

Bureau of Meteorology (2019/ 2020) Climate Averages for Kalgoorlie Boulder viewed October & November 2019, January 2020, www.bom.gov.au

Centre for Australian National Biodiversity Research (2015) EUCLID Eucalypts of Australia 4th Edition – Factsheets (online interactive key), CSIRO

Centre for Plant Biodiversity Research (2006) Euclid – Eucalypts of Australia 3rd Edition. Interactive CD. CSIRO Publishing

Cowan M (2001) Coolgardie 3 (COO3 – Eastern Goldfields subregion) in May J E & McKenzie N L (eds) Biodiversity audit of Western Australia's 53 biogeographical subregions in 2002. Department of Conservation and Land Management, Perth WA

Department of Biodiversity, Conservation and Attractions (2019a) List of Priority Ecological Communities endorsed by the Western Australian Minister for the Environment, DPaW Perth WA

Department of Biodiversity, Conservation and Attractions (2019b) List of Threatened Ecological Communities endorsed by the Western Australian Minister for the Environment, DPaW Perth WA

Department of Biodiversity, Conservation and Attractions (2019c), *NatureMap,* accessed October 2019 and January 2020; naturemap.dbca.wa.gov.au

EPA 2016 *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*

G & G Environmental (2007) Flora and vegetation survey of proposed mining areas and a tailings storage facility at the Monarch Gold Mining Company Limited, Davyhurst Operations, Unpublished report for Monarch Gold Mining Company Ltd.

Gibson N and Langley M A (2012) Vascular flora of Credo Station and adjacent reserves. A report to the Bush Blitz Program, Australian Biological Resources Study. Department of Environment and Conservation, Perth WA

Government of Western Australia (2019) – 2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (full report). Current as of March 2019. WA Department of Biodiversity, Conservation and Attractions, Perth.

Hussey B M J, Keighery G J, Dodd J, Lloyd S G and Cousens R D (2007) Western Weeds – A guide to the weeds of Western Australia. Published by The Weeds Society of Western Australia

Jenny Borger Botanical Consulting (Unpublished) Data from analogue quadrats established for EGS in 2017

Keighery, B. (1994). Bushland Plant Survey – A guide to Plant Community Survey for the Community, Wildflower Society of WA (Inc.)

Maslin, B.R. (coordinator) 2018. WATTLE, Interactive Identification of Australian Acacia. Version 3. (Australian Biological Resources Study, Canberra; Department of Biodiversity, Conservation and Attractions, Perth; Identic Pty. Ltd., Brisbane)

Meissner R. A, and Coppen R. (2013) Flora and vegetation of the greenstone ranges of the Yilgarn Craton: Credo Station. *Conservation Science Western Australia 8 (3): 333 – 343*

Munsell Color Company (1992) Soil Color Charts. Macbeth Division of Kollmorgen Instruments Group, New York USA

NVIS Technical Working Group (2017) Australian Vegetation Attribute Manual: National Vegetation Information System, Version 7.0. Department of the Environment and Energy, Canberra. Prep by Bolton, M.P., deLacey, C. and Bossard, K.B. (Eds)

Olde P. and Marriott N (1995) The Grevillea Book (volumes 2 & 3). Kangaroo Press Ltd, Kenthurst NSW

Outback Ecology (2007) Flora survey of Salmon Gums, Two Gums, Federal Flag, Walhalla, Golden Eagle, Makai, Sand King, Missouri and Lady Bountiful sites for Monarch Gold Mining Company Ltd: Davyhurst Gold Mine

Plant Ecology Consulting (2015) Siberia Mine, Davyhurst Flora and Vegetation Survey, Kingsley WA *for* Piacentini & Son (2016) – Level 1 Flora and Fauna Survey Siberia Minesite – Eastern Goldfields Ltd.

Pringle H. J. R, Van Vreeswyk A. M. E. and Gilligan S. A. (1994) An inventory and condition survey of the north-eastern Goldfield, Western Australia. Department of Agriculture, Western Australia Technical Bulletin No. 87

Thackway R and Cresswell I D (2017), *An Interim Biogeographic Regionalisation for Australia: a framework for establishing the national system of reserves, Version 7.0* Canberra: Australia Nature Conservation Agency

Western Australian Herbarium (2019) *FloraBase – the Western Australian Flora*, accessed October 2019 and January 2020, URL http://florabase.dbca.wa.gov.au

Wilkins C F and Chappill (2007) Five new species of *Eutaxia* (Leguminosae: Mirbelieae) from south-western Australia. Nuytsia 17: 469 – 482. Department of Environment and Conservation Western Australia

## Appendix 1: Species list

| Family | Scientific Name | Code |
|---|---|---|
| **Amaranthaceae** | *Ptilotus obovatus* | |
| **Apocynaceae** | *Vincetoxicum lineare* | |
| **Asteraceae** | *Cratystylis subspinescens* | |
| | *Olearia muelleri* | |
| | *Vittadinia dissecta* var. *hirta* | |
| | *Waitzia acuminata* | |
| **Casuarinaceae** | *Allocasuarina acutivalvis* subsp. *acutivalvis* | |
| | *Allocasuarina dielsiana* | |
| | *Casuarina pauper* | |
| **Chenopodiaceae** | *Atriplex vesicaria* | |
| | *Dissocarpus paradoxus* | |
| | *Enchylaena lanata* | |
| | *Maireana georgei* | |
| | *Maireana sedifolia* | |
| | *Maireana trichoptera* | |
| | *Rhagodia drummondii* | |
| | *Salsola australis* | |
| | *Sclerolaena cuneata* | |
| | *Sclerolaena diacantha* | |
| | *Sclerolaena fusiformis* | |
| **Cucurbitaceae** | *Cucumis myriocarpus** | Alien |
| **Euphorbiaceae** | *Euphorbia drummondii* | |
| **Fabaceae** | *Acacia aneura* | |
| | *Acacia burkittii* | |
| | *Acacia caesaneura* | |
| | *Acacia colletioides* | |
| | *Acacia craspedocarpa* | |
| | *Acacia effusifolia* | |
| | *Acacia erinacea* | |
| | *Acacia hemiteles* | |
| | *Acacia incurvaneura* | |
| | *Acacia mulganeura* | |
| | *Acacia ramulosa* var. *ramulosa* | |
| | *Acacia tetragonophylla* | |
| | *Bossiaea walkeri* | |
| | *Senna artemisioides* subsp. *filifolia* | |

| Family | Scientific Name | Code |
|---|---|---|
| **Fabaceae** | *Senna cardiosperma* | |
| **Goodeniaceae** | *Scaevola spinescens* | |
| **Gyrostemonaceae** | *Codonocarpus cotinifolius* | |
| **Lamiaceae** | *Prostanthera grylloana* | |
| | *Salvia verbenaca** | Alien |
| | *Westringia cephalantha* var. *cephalantha* | |
| **Loranthaceae** | *Amyema gibberula var. gibberula* | |
| **Malvaceae** | *Brachychiton gregorii* | |
| | *Radyera farragei* | |
| | *Sida calyxhymenia* | |
| | *Sida spodochroma* | |
| **Myrtaceae** | *Eucalyptus clelandiorum* | |
| | *Eucalyptus griffithsii* | |
| | *Eucalyptus oleosa* subsp. *oleosa* | |
| | *Eucalyptus salmonophloia* | |
| | *Eucalyptus salubris* | |
| **Poaceae** | *Austrostipa elegantissima* | |
| | *Austrostipa nitida* | |
| | *Triodia scariosa* | |
| **Proteaceae** | *Grevillea nematophylla* subsp. *nematophylla* | |
| **Rutaceae** | *Phebalium filifolium* | |
| | *Philotheca brucei* subsp. *brucei* | |
| **Santalaceae** | *Exocarpos aphyllus* | |
| | *Santalum spicatum* | Registered |
| **Sapindaceae** | *Alectryon oleifolius* subsp. *canescens* | |
| | *Dodonaea lobulata* | |
| | *Dodonaea rigida* | |
| **Scrophulariaceae** | *Eremophila clarkei* | |
| | *Eremophila decipiens* subsp. *decipiens* | |
| | *Eremophila eriocalyx* | |
| | *Eremophila granitica* | |
| | *Eremophila interstans* subsp. *interstans* | |
| | *Eremophila oldfieldii* subsp. *angustifolia* | |

| Family | Scientific Name | Code |
|---|---|---|
| **Scrophulariaceae** | *Eremophila scoparia* | |
| | *Eremophila* sp. Mt Jackson (G J Keighery 4372) | |
| **Solanaceae** | *Solanum lasiophyllum* | |
| | *Solanum plicatile* | |
| **Zygophyllaceae** | *Roepera aurantiaca* | |
| | *Roepera ovata* | |

## Appendix 2: GPS locations of *Santalum spicatum*

| Scientific Name | Easting | Northing | No. |
|---|---|---|---|
| *Santalum spicatum* | 303595 | 6655128 | 1 |
| *Santalum spicatum* | 303628 | 6655098 | 1 |

## Appendix 3: Site descriptions

| 3.1 Siberia Quadrat Q1 | |
|---|---|
| Date: 3rd November 2019 | Location: East of ROM |
| NW: 304072/ 6655534 | Landform: Plain; lower catchment |
| | Elevation: 423 m a s l |
| Land surface: Red (2.5 YR 5/8) sandy clay loam, dry; litter 50 %, 2 – 4 cm deep; fallen timber 15 – 20 %; cryptogam cover 50 % (lichen); bare ground 30 % | |
| Disturbance: Nearby disturbances (mining activities – old tracks, drilling); rabbits, drought impacts > decline in recruitment and understorey | |
| Condition: Very good to excellent | |
| NVIS – VI: U+^ *Eucalyptus griffithsii\Eucalyptus\^tree\6\i; U2^ Acacia caesaneura, Acacia hemiteles, Acacia colletioides, Eremophila scoparia, Acacia burkittii\Acacia\^shrub\4\i; M1^Acacia hemiteles, Acacia burkittii, Senna artemisioides subsp. filifolia, Acacia ramulosa var. ramulosa, Eremophila scoparia\Acacia\^shrub\3\i; M2^Acacia hemiteles, Acacia colletioides, Acacia ramulosa var. ramulosa, Scaevola spinescens, Senna artemisioides subsp. filifolia\Acacia\^shrub\2\i; G^ Triodia scariosa\Triodia\^hummock grass\1\bi* | |

| Height m | % cover | Habit | Species | No. |
|---|---|---|---|---|
| 2 – 10 | 15 | Tree | *Eucalyptus griffithsii* | 4 |
| >2 | 20 – 30 | Shrub | *Acacia caesaneura (6), Acacia hemiteles (3); Acacia colletioides (2); Eremophila scoparia (2); Acacia burkittii (2); Grevillea nematophylla* subsp. *nematophylla (1)* | 16 |
| 1 – 2 | 20 | Shrub | *Acacia hemiteles (10); Acacia burkittii (5); Senna artemisioides* subsp. *filifolia (19); A. ramulosa var. ramulosa (3); Eremophila scoparia (3); Acacia tetragonophylla (1); A. colletioides (1), Dodonaea lobulata (1)* | 43 |
| 0.5 – 1 | 10 | Shrub | *Acacia hemiteles (4); A. colletioides (2); Scaevola spinescens (2); Eremophila scoparia (3); Senna artemisioides subsp. filifolia (2); Eremophila sp. Mt Jackson (1)* | 15 |
| <0.5 | 5 | Shrub | *Acacia ramulosa var. ramulosa (3); Scaevola spinescens (1); Eremophila scoparia (1)* | 5 |
| <0.5 | <1 | Tussock grass | *Triodia scariosa (1)* | 1 |
| | | Forbs | Not present | |

Other species: *Westringia cephalantha, Eucalyptus oleosa* subsp. *oleosa*

*Eucalyptus griffithsii* low open woodland over *Acacia caesaneura, Acacia hemiteles, Acacia colletioides, Grevillea nematophylla* subsp. *nematophylla, Acacia burkittii* tall open shrubland over *Acacia hemiteles, Acacia burkittii, Senna artemisioides* subsp. *filifolia, A. ramulosa var. ramulosa, Eremophila scoparia open shrubland over Acacia hemiteles, A. ramulosa var. ramulosa, Scaevola spinescens, Eremophila scoparia, A. colletioides low opens shrubland over Triodia scariosa low isolated tussock grasses*

**Siberia Quadrat 1 site photo**

## 3.2 Siberia Quadrat Q2

| | |
|---|---|
| Date: 3rd November 2019 | Location: SE of Sand King Waste Dump |
| NW: 304337/ 6655413 | Landform: Low rise |
| | Elevation: 427 |
| Land surface: Yellowish red (5YR 5/8) fine sandy clay loam; surface rock – ironstone gravel, 5 – 25 mm, 50 – 60 %; litter 60 % 1 – 5 cm deep; fallen timber 20 %; cryptogam cover (lichen) 70 – 80 %; surface dry | |
| Disturbance: historic timber harvesting; some loss of understorey likely (grasses); rabbits sighted nearby; old drought impacts; old overgrown drill tracks and locations | |
| Condition: very good to excellent in broader area; most areas in excellent condition | |
| NVIS – VI: U1+^ *Acacia ramulosa* var. *ramulosa, ^Acacia caesaneura, ^Grevillea nematophylla* subsp. *nematophylla, Acacia incurvaneura, Acacia burkittii\Acacia\^shrub, tree\4\c; M1^ ^Eremophila granitica, Eremophila eriocalyx, Grevillea nematophylla* subsp. *nematophylla, Prostanthera grylloana\Eremophila\^shrub\3\i; M2^Eremophila granitica, Eremophila eriocalyx, Prostanthera grylloana, Acacia ramulosa var. ramulosa\Eremophila\^shrub\2\r; G1^Waitzia acuminata\Waitzia\^forb\1\bi* | |

| Height m | % cover | Habit | Species | No. |
|---|---|---|---|---|
| 2 – 10 | < 1 | Tree | *Brachychiton gregorii* | 1 |
| 2 – 10 | 35 – 40 | Shrub, tree | *Acacia ramulosa* var. *ramulosa (7), A. caesaneura (7), A. incurvaneura (4), Grevillea nematophylla* subsp. *nematophylla (7), A. burkittii (2), A. tetragonophylla (1), Eremophila eriocalyx (6)* | 34 |
| 1 – 2 | 15 – 20 | Shrub | *Eremophila granitica (41), E. eriocalyx (30), Grevillea nematophylla* subsp. *nematophylla (2), Prostanthera grylloana (2)* | 75 |
| 0.5 – 1 | 8 – 10 | Shrub | *Eremophila granitica (32), E. eriocalyx (10), Prostanthera grylloana (13)* | 55 |
| <0.5 | < 1 | Shrub | *Acacia ramulosa var. ramulosa (3), Prostanthera grylloana (2), Eremophila eriocalyx (4), E. granitica (9)* | 18 |
| <0.2 | <1 | Forb | *Waitzia acuminata* | |
| Aerial | <1 | Mistletoe | *Amyema gibberula var. gibberula (on Grevillea)* | 2 |

Other species: *Acacia aneura, A. mulganeura, Eucalyptus oleosa* subsp. *oleosa*

*Eucalyptus oleosa* subsp. *oleosa isolated* mallee trees over *Acacia ramulosa* var. *ramulosa, A. caesaneura, A. incurvaneura, Grevillea nematophylla* subsp. *nematophylla, A. burkittii* tall shrubland over *Eremophila granitica, E. eriocalyx, Prostanthera grylloana, Grevillea nematophylla* subsp. *nematophylla* open shrubland over *Eremophila granitica, E. eriocalyx, Prostanthera grylloana, Acacia ramulosa* var. *ramulosa* low sparse shrubland over *Waitzia acuminata* low isolated forbs

**Siberia Quadrat 2 site photo (NW)**

## 3.3 Siberia Quadrat Q3

| | |
|---|---|
| Date: 3rd November 2019 | Location: East of ROM and southern waste dump |
| NW: 304094/ 6655243 | Landform: Plain; broad flood plain; flat |
| | Elevation: 423 |
| Land surface: Yellowish red (5YR 4/6) clay loam; surface rock ironstone gravel, 2 – 40 mm, 70 – 80 %; litter 15 – 20 % 1 – 4 cm deep; fallen timber 10 %; cryptogam cover (lichen) < 5 %; bare ground 15 – 20 % | |
| Disturbance: decline in understorey (mid stratum); historic clearing; evidence of grazing; signs of cattle, donkeys and rabbits in area; evidence of sheet wash; ironstone gravel provides some protection | |
| Condition: Good to very good – significant areas of recent regrowth of *Eucalyptus salmonophloia* adjacent to site; high counts of ground cover species – recruitment occurring; tree hollows present in Salmon gum | |
| NVIS – VI: U1+^*Eucalyptus salmonophloia\Eucalyptus\^tree\7\i; M1^ Eremophila interstans subsp. interstans\Eremophila\^shrub\4\bi; M2^ Eremophila interstans subsp. interstans, Exocarpos aphyllus, Eremophila scoparia, Senna cardiosperma, Casuarina pauper\Eremophila\^shrub\3\r; M3^ ^Acacia hemiteles, ^Eremophila scoparia, ^ Eremophila interstans subsp. interstans, Scaevola spinescens, Acacia tetragonophylla\Acacia\^shrub\2\r; G ^Sclerolaena cuneata, Acacia erinacea, Dissocarpus paradoxus, Scaevola spinescens, Sclerolaena diacantha\Sclerolaena\^chenopod shrub, shrub\1\r* | |

| Height m | % cover | Habit | Species | No. |
|---|---|---|---|---|
| > 10 | 25 | Tree | *Eucalyptus salmonophloia* | 1 |
| >2 | 1 – 2 | Shrub | *Eremophila interstans* subsp*. interstans* | 5 |
| 1 – 2 | 5 – 10 | Shrub | *Eremophila interstans* subsp*. interstans (5), Exocarpos aphyllus (1), Eremophila scoparia (2), Senna cardiosperma (2), Acacia hemiteles (2), Casuarina pauper (1)* | 13 |
| 0.5 – 1 | 5 – 10 | Shrub | *Eremophila scoparia (5), Acacia hemiteles (7), Eremophila interstans* subsp*. interstans (5), Acacia tetragonophylla (2), A. erinacea (1), Scaevola spinescens (2), Cratystylis subspinescens (2), Senna artemisioides* subsp. *filifolia (2), Exocarpos aphyllus (1), Atriplex vesicaria (2)* | 29 |
| <0.5 | 5 – 10 | Shrub | *Sclerolaena cuneata (226), Acacia erinacea (23), Dissocarpus paradoxus (14), Scaevola spinescens (6), Sclerolaena diacantha (18), Atriplex vesicaria (7), Maireana georgei (6), Acacia tetragonophylla (2), Senna cardiosperma (1), Enchylaena lanata (1), Senna artemisioides* subsp. *filifolia (1), Ptilotus obovatus (2), Rhagodia drummondii (1), Maireana trichoptera (2)* | 311 |
| <0.5 | <1 | Grass tussock | *Austrostipa elegantissima (2)* | |
| <0.2 | <1 | Forb | *Roepera ovata* (tentative; sterile) | |

Other species: *Bossiaea walkeri, Eremophila* sp. Mt Jackson, *Olearia muelleri, Solanum lasiophyllum*; calcrete present at the surface in some areas

*Eucalyptus salmonophloia* open woodland over *Eremophila interstans* subsp*. interstans* tall sparse shrubland over *Eremophila interstans* subsp*. interstans*, *Exocarpos aphyllus*, *Eremophila scoparia, Acacia hemiteles* sparse shrubland over *Acacia erinacea, Sclerolaena cuneata, Scaevola spinescens, Dissocarpus paradoxus*, *Sclerolaena diacantha* low sparse shrubland over *Roepera ovata* low isolated forbs

**Siberia Quadrat 3 site photo**

| | |
|---|---|
|  |  |
| North side of quadrat > east | *Dissocarpus paradoxus* growing near fallen timber. |

## 3.4 Siberia Quadrat Q4

| | |
|---|---|
| Date: 3rd November 2019 | Location: East of Missouri Waste Dump; north of Ora Banda |
| NW: 303568 | Landform: Low hill; ridge |
| | Elevation: 429 |
| Land surface: brown (7.5 YR 5/4) clay loam; surface rock ironstone gravel and calcrete 70 – 80 %, 5 – 50 mm; litter 60 – 70 %, 1 – 5 cm deep; fallen timber 20 %; cryptogam cover (lichen) ~ 10 %; bare ground 20 – 30 %; land surface dry | |
| Disturbance: Timber harvesting; mining exploration disturbances; rabbits, cattle; grazing obvious on Scaevola, Acacia and Casuarina. | |
| Condition: Good | |
| NVIS – VI: U1+ ^ *Eucalyptus clelandiorum\Eucalyptus\^tree\7\c; M1 ^ Eremophila sp. Mt Jackson\Eremophila\^shrub\4\bi;* M2 ^ *Eremophila sp. Mt Jackson, Dodonaea lobulata, Senna artemisioides subsp. filifolia, Casuarina pauper, Exocarpos aphyllus\Eremophila\^shrub\3\i; M3 ^ Eremophila sp. Mt Jackson, Scaevola spinescens, Casuarina pauper, Olearia muelleri, Ptilotus obovatus\Eremophila\^shrub\2\i; G1^Maireana georgei, Maireana sedifolia, Roepera aurantiaca, Austrostipa nitida, Sida spodochroma\Maireana\^chenopod shrub, forb, grass, shrub\1\bi* | |

| Height m | % cover | Habit | Species | No. |
|---|---|---|---|---|
| > 10 | 20 | Tree | *Eucalyptus clelandiorum* | 2 |
| 2 – 10 | 30 | Tree | *Eucalyptus clelandiorum* | 8 |
| >2 | < 1 | Shrub | *Eremophila* sp. Mt Jackson | 2 |
| 1 – 2 | 10 – 15 | Shrub | *Eremophila* sp. Mt Jackson *(24), Dodonaea lobulata (4), Senna artemisioides* subsp*. filifolia (3), Casuarina pauper (3), Exocarpos aphyllus (1), Acacia effusifolia (1)* | 36 |
| 0.5 – 1 | 10 – 15 | Shrub | *Eremophila* sp. Mt Jackson *(15), Casuarina pauper (8), Dodonaea lobulata (4), Olearia muelleri (2), Ptilotus obovatus (2), Scaevola spinescens (1)* | 32 |
| <0.5 | 2 – 5 | Shrub | *Scaevola spinescens (13), Eremophila* sp. Mt Jackson *(18), Casuarina pauper (6), Olearia muelleri (7), Ptilotus obovatus (8), Senna artemisioides subsp. filifolia (7), Acacia erinacea (2), Solanum lasiophyllum (4), Maireana georgei (3), M. sedifolia (1), Sida spodochroma (2)* | 70 |
| <0.3 | <1 | Grass tussock | *Austrostipa nitida* | |
| <0.1 | <1 | Forb | *Roepera aurantiaca* | |

*Eucalyptus clelandiorum* woodland over *Eremophila* sp. Mt Jackson, *Dodonaea lobulata, Senna artemisioides subsp. filifolia, Casuarina pauper, Exocarpos aphyllus, Acacia effusifolia* open shrubland over *Eremophila* sp. Mt Jackson, *Casuarina pauper, Olearia muelleri, Scaevola spinescens, Dodonaea lobulata, Ptilotus obovatus* low open shrubland over *Austrostipa nitida, Roepera aurantiaca* low isolated grass tussocks and forbs

**Siberia Quadrat 4 (NW)**

## 3.5 Siberia Quadrat Q5
## (Missouri Analogue AMQ02)

| | |
|---|---|
| Date: 15th February 2017 | Location: South of Missouri Waste Dump; east of Ora Banda – Davyhurst Road |
| NW: 303894/6655543 | Landform: Plain; flat |
| | Elevation: 423 |
| Land surface: Yellowish red clay loam; surface rock 40 – 50 % ironstone gravel < 3mm; litter 40 – 50 % ^ 20 cm; fallen timber 3 – 5 %; cryptogam cover 15 – 20 % (lichen); bare ground < 10 %; surface dry, damp at depth | |
| Disturbance: low level of disturbance; old exploration tracks nearby; echidna diggings; some grazing on *Acacia* spp. | |
| Condition: Excellent; very healthy, all strata present; recruitment occurring | |
| NVIS – VI: U1+ ^ *Eucalyptus griffithsii , Casuarina pauper\Eucalyptus\^tree\6\c; M1^ Acacia burkittii, Acacia incurvaneura, Grevillea nematophylla* subsp. *nematophylla, Acacia ramulosa var. ramulosa, Acacia tetragonophylla\Acacia\^shrub, tree\4\i; M2 ^ Acacia ramulosa var. ramulosa, ^Acacia tetragonophylla, Acacia burkittii, Acacia incurvaneura, Senna artemisioides subsp. filifolia\Acacia\^shrub\3\i; M3 ^ Dodonaea rigida, Acacia tetragonophylla, Dodonaea lobulata, Senna artemisioides* subsp. *filifolia, Acacia incurvaneura\Dodonaea\shrub\2\r; ^Austrostipa elegantissima, Sida calyxhymenia, Solanum lasiophyllum\Austrostipa\^tussock grass, forb, shrub\1\bi* | |

| Height m | % cover | Habit | Species | No. |
|---|---|---|---|---|
| 4 – 8 | 30 – 40 | Tree, mallee | *Eucalyptus griffithsii (12), Casuarina pauper (2)* | 12 |
| >2 | 20 – 25 | Shrub, tree | *Acacia burkittii (8), Acacia incurvaneura (6), Grevillea nematophylla* subsp. *nematophylla (4), Acacia ramulosa var. ramulosa (2), A. tetragonophylla (1)* | 19 |
| 1 – 2 | 10 – 15 | Shrub | *Acacia ramulosa var. ramulosa (8), A. tetragonophylla (9), A. burkittii (5), A. incurvaneura (5), Senna artemisioides subsp. filifolia (13), Acacia hemiteles (1), Dodonaea lobulata (2)* | 43 |
| 0.5 – 1 | 3 – 5 | Shrub | *Dodonaea rigida (17), Acacia tetragonophylla (8), Dodonaea lobulata (4), Senna artemisioides* subsp. *filifolia (2), Acacia incurvaneura (1)* | 32 |
| <0.5 | 1 – 2 | Shrub, vine | *Dodonaea rigida (5), Acacia tetragonophylla (3), A. ramulosa var. ramulosa (2), A. incurvaneura (1), Senna artemisioides subsp. filifolia (1), Scaevola spinescens (1), Vincetoxicum lineare (3), Sida calyxhymenia (3), Solanum lasiophyllum (5; seedlings), seedlings (10; unknown; possibly Proteaceae)* | 34 |
| <0.5 | < 1 | Tussock grass | *Austrostipa elegantissima* | 1 |

Other species: *Bossiaea walkeri*

*Eucalyptus griffithsii* and *Casuarina pauper* low open forest over *Acacia burkittii, A. incurvaneura*, *Grevillea nematophylla* subsp. *nematophylla, Acacia ramulosa var. ramulosa, Acacia tetragonophylla* tall open shrubland over *Acacia ramulosa* var. *ramulosa, A. tetragonophylla, Dodonaea rigida, Senna artemisioides* subsp. *filifolia, Acacia burkittii, Dodonaea lobulata* open shrubland over *Dodonaea rigida, Acacia tetragonophylla, Acacia ramulosa* var. *ramulosa, Senna artemisioides* subsp. *filifolia* low isolated shrubs over *Austrostipa elegantissima* low isolated tussock grasses

**Siberia Quadrat 5 site photo**

## 3.6 Siberia Quadrat Q6
## (Missouri Analogue Quadrat 1)

| | | |
|---|---|---|
| Date: 14th February 2017 | | Location: South of waste dump |
| NW: 303271/ 6654641 | NE: 303288/ 6654651 | Landform: Low hill, gentle slope |
| SW: 303283/ 6654626 | SE: 303300/ 6654638 | Elevation: 421 m a s l |
| Land surface: Yellowish red (5YR 5/8) clay loam to fine sandy clay loam; moist at depth<br>Litter 20 – 30 % ^ 6cm; fallen timber < 2 % - few old large branches, stems; Cryptogams lichen < 1%; surface rock ironstone, calcrete (from old diggings) > 70 % 0.5 (1 – 2) > 5 cm, with a few larger rocks > 20 cm in SE corner | | |
| Disturbance: Historic mining impacts – old access tracks, drill locations and minor diggings; current – goats (grazing obvious on Allocasuarina) and rabbits | | |
| Condition: very good – some clearing in understorey; semi mature regrowth *Eucalyptus* spp. | | |
| NVIS VI: U1+ ^ *Eucalyptus griffithsii , Allocasuarina acutivalvis* subsp*. acutivalvis, Eucalyptus salubris\^mallee, tree\Eucalyptus\6\i; M1^ Eremophila scoparia, Alectryon oleifolius* subsp. *canescens, Acacia tetragonophylla\Eremophila\^shrub\4\r; M2 ^ Dodonaea lobulata, Acacia tetragonophylla, Eremophila scoparia, Scaevola spinescens, Allocasuarina acutivalvis* subsp*. acutivalvis\Dodonaea\^shrub\3\r; M3 ^ Eremophila scoparia, Olearia muelleri, Acacia tetragonophylla, Dodonaea lobulata, Senna artemisioides subsp. filifolia\Eremophila\^shrub\2\r; ^ Olearia muelleri, Sclerolaena fusiformis, Ptilotus obovatus, Dodonaea lobulata, Sclerolaena fusiformis\Olearia\^shrub, forb\1\r* | | |

| Height m | % cover | Habit | ***Species*** | No. |
|---|---|---|---|---|
| 2 – 8 | 2 – 3 | Tree | *Allocasuarina acutivalvis* subsp*. acutivalvis (2), Eucalyptus salubris (2)* | 4 |
| <8 | 20 – 25 | Mallee | *Eucalyptus griffithsii (4)* | 4 |
| >2 | 8 – 10 | Shrub | *Eremophila scoparia (4), Alectryon oleifolius* subsp. *canescens (1), Acacia tetragonophylla (1)* | 6 |
| 1 – 2 | 5 – 10 | Shrub | *Dodonaea lobulata (8), Acacia tetragonophylla (1), Eremophila scoparia (3), Scaevola spinescens (2), Allocasuarina acutivalvis* subsp*. acutivalvis (2), Senna artemisioides subsp. filifolia (1), Eremophila oldfieldii subsp. angustifolia (1)* | 18 |
| 0.5 – 1 | 5 – 7 | Shrub | *Eremophila scoparia (43), Olearia muelleri (2), Acacia tetragonophylla (7), Dodonaea lobulata (5), Senna artemisioides* subsp*. filifolia (1)* | 58 |
| <0.5 | 4 – 5 | Shrub | *Olearia muelleri (24), Eremophila scoparia (10), Allocasuarina acutivalvis* subsp. *acutivalvis (6), Ptilotus obovatus (4), Dodonaea lobulata (8)* | 52 |
| <0.2 | <1 | Forb | *Sclerolaena fusiformis, S. diacantha, Sida calyxhymenia* | |
| | <1 | Vine | *Rhyncharrhena linearis* | 1 |

Other species: *Acacia burkittii* – part crown in quadrat

*Eucalyptus griffithsii, Allocasuarina acutivalvis* subsp*. acutivalvis, Eucalyptus salubris* mallee woodland over *Eremophila scoparia, Alectryon oleifolius* subsp. *canescens, Acacia tetragonophylla, A. burkittii* tall sparse shrubland over *Dodonaea lobulata, Acacia tetragonophylla, Eremophila scoparia, Scaevola spinescens, Allocasuarina acutivalvis* subsp*. acutivalvis* sparse shrubland over *Eremophila scoparia, Olearia muelleri, Dodonaea lobulata, Acacia tetragonophylla, Allocasuarina acutivalvis* subsp. *acutivalvis* low sparse shrubland over *Sclerolaena fusiformis, S. diacantha, Sida calyxhymenia* low isolated forbs

**Siberia Quadrat 6 site photo**

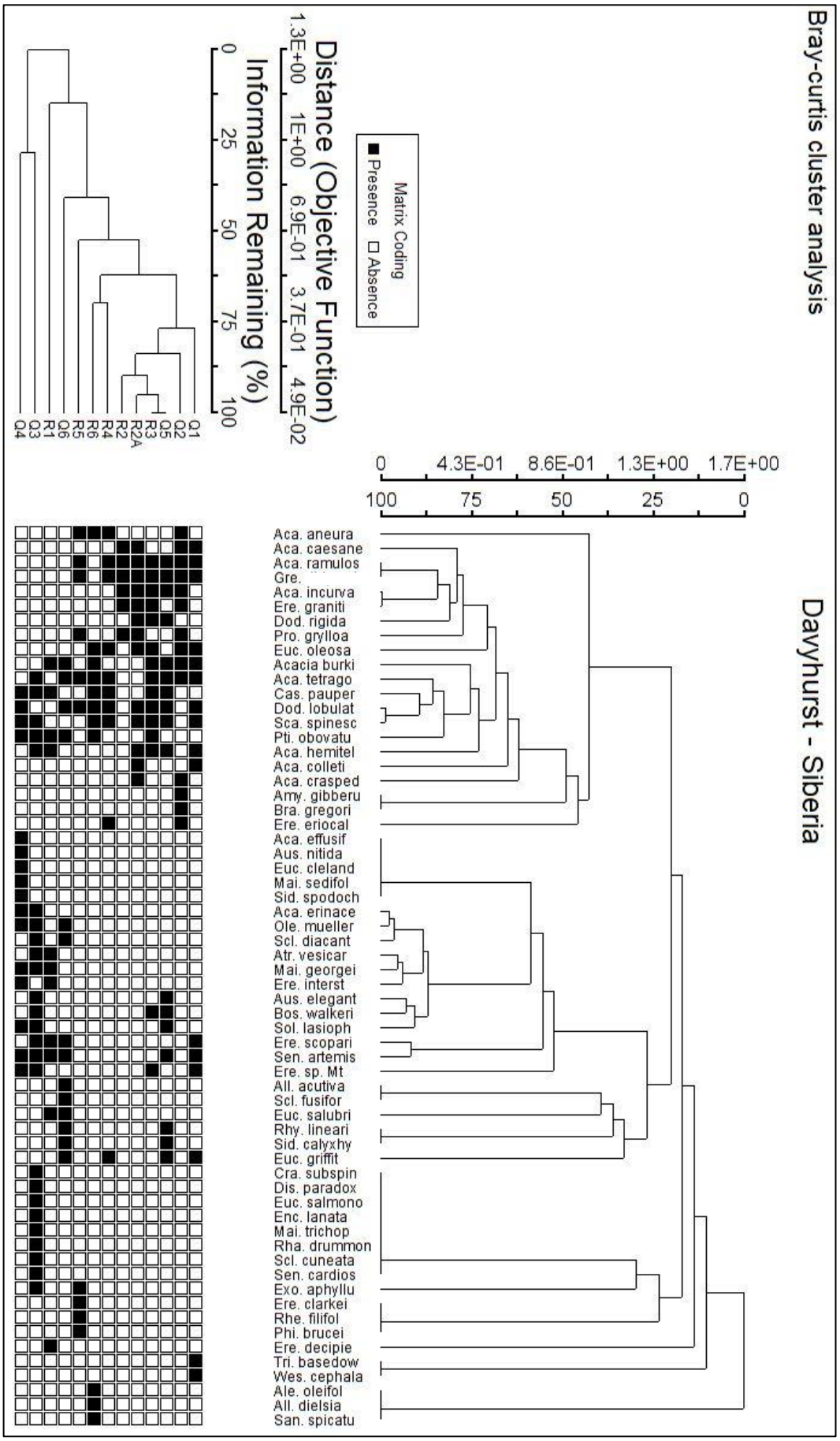
## Appendix 4: Relevé descriptions and photos

| **Relevé R01** | **GPS: 303725/ 6655665** |
|---|---|
| High level of disturbance; adjacent to ROM and access tracks; regrowth; Condition: good – structure compromised; mid to upper strata not present in much of the area; signs of cattle and donkeys | Plain; broad flat valley<br><br>Condition: Degraded to good in area |
| Vegetation: *Eucalyptus salubris, Acacia burkittii, A. hemiteles* open shrubland over *Casuarina pauper, Ptilotus obovatus, Maireana georgei, Eremophila scoparia, E. interstans, E. decipiens* subsp. *decipiens, Atriplex vesicaria* and *Senna artemisioides* subsp. *filifolia* low open mixed shrubland | |
| **Relevé R02 (Near Q2)** | **304344/ 6655459** |
| Condition: very good to excellent; low level of disturbance | Low hill; gentle slope |
| *Acacia caesaneura, A. incurvaneura*, *Grevillea nematophylla* subsp. *nematophylla*, *Acacia ramulosa* var. *ramulosa* tall shrubland over *Prostanthera grylloana, Eremophila granitica* low open shrubland | |
| **Relevé R02A Q2 to vegetation change at 304150/ 6655346** | |
| Historic disturbances – exploration tracks and drill locations overgrown | Low hill; condition very good to excellent |
| *Eucalyptus oleosa* subsp. *oleosa* mallee (8 – 9 m) isolated in *Acacia caesaneura, A. incurvaneura, A. craspedocarpa*, *Grevillea nematophylla* subsp. *nematophylla* tall shrubland/ low woodland over *Acacia ramulosa* var. *ramulosa*, Grevillea *nematophylla* subsp. *nematophylla*, *Acacia colletioides, A. hemiteles, Dodonaea lobulata, D. rigida, Scaevola spinescens* shrubland to open shrubland over *Prostanthera grylloana, Eremophila granitica, Scaevola spinescens, Dodonaea lobulata* low open shrubland over isolated *Waitzia acuminata* low forbs and low grass tussocks (dried off/ grazed) | |
| **Relevé 03 (SW of Q3)** | **303970/ 6655164** |
| Lower slope; gently sloping; calcrete at surface<br>Condition: good to very good<br><br>Various levels of disturbances in area – old tracks, historic clearing (mining, pastoral); semi-mature regrowth<br>Rainbow bee-eaters present in area |  |
| *Casuarina pauper, Eucalyptus oleosa* low open woodland over *Eremophila* sp. Mt Jackson, *Acacia ramulosa* var. *ramulosa, A. burkittii, A. hemiteles, Dodonaea rigida, Acacia tetragonophylla* open shrubland over *Scaevola spinescens, Dodonaea lobulata, Grevillea* sp., and *Bossiaea walkeri* low open shrubland over *Sida calyxhymenia, Ptilotus obovatus* low sparse shrubs<br><br>Other species: *Eremophila granitica, Acacia incurvaneura, Codonocarpus cotinifolius* | |

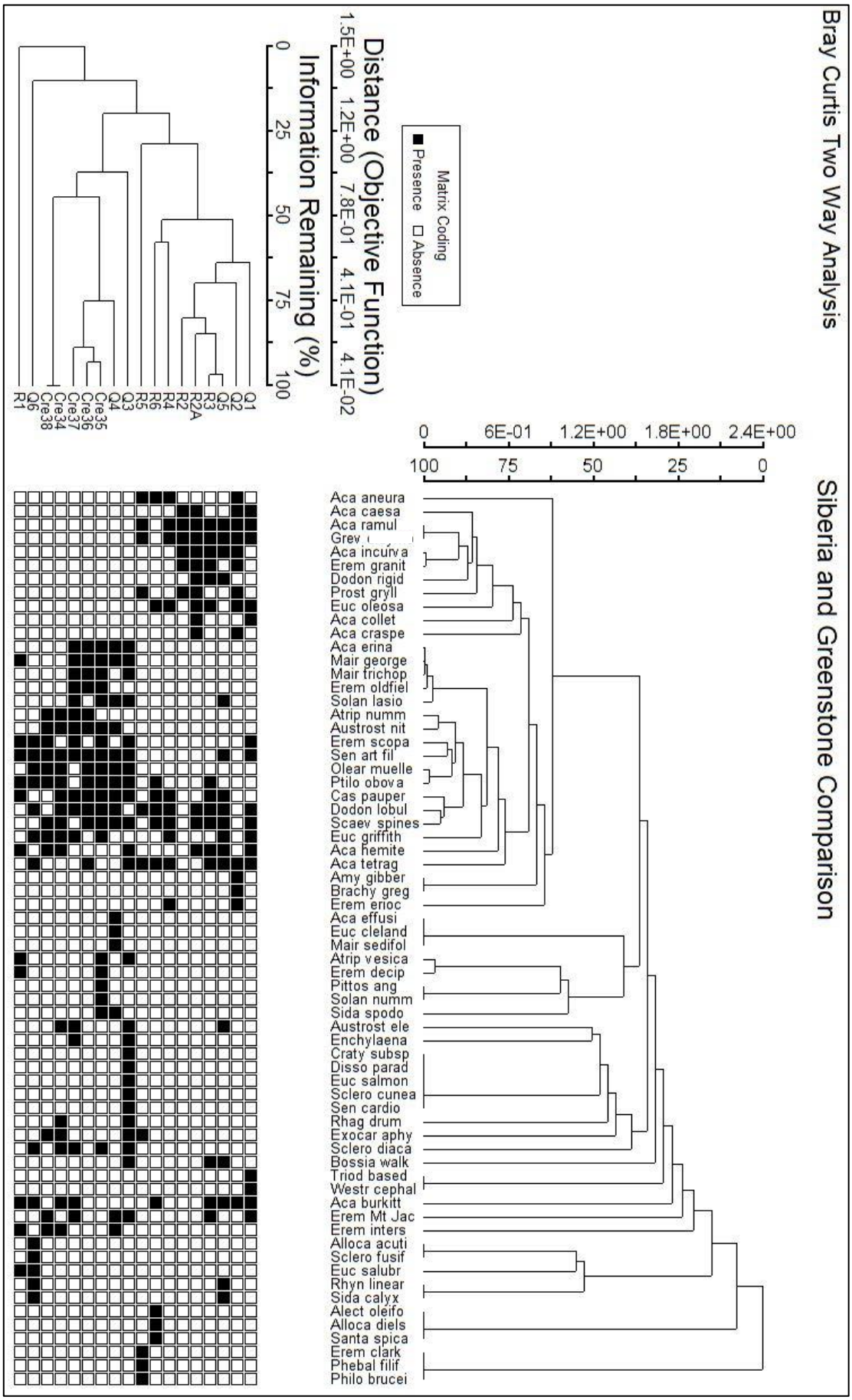
| **Relevé 04** | **303672/ 6655169** |
|---|---|
| Low stony rise; midslope<br>Condition: very good; old tracks in area; some drought impacts – old deaths; isolated ground cover (< 1 %)<br><br>Rainbow bee-eaters in area |  |
| *Eucalyptus griffithsii, E. oleosa* low open mallee woodland (8 – 9 m)over *Acacia aneura, Grevillea didymobotrya subsp. didymobotrya, Casuarina pauper, Acacia ramulosa var. ramulosa* tall open shrubland (2 – 5 m) over *Acacia tetragonophylla, Grevillea nematophylla* subsp. *nematophylla, Scaevola spinescens, Dodonaea lobulata, Acacia aneura, Eremophila eriocalyx* open shrubland (1 – 2 m) over *Scaevola spinescens, Dodonaea lobulata* low sparse shrubland | |
| **Relevé 05** | **303639/ 6655520** |
| Stony hill; crest; > 80% rock – hematite/ ironstone large rocks to boulders<br>Condition: excellent – good cover of litter; basically undisturbed |  |
| *Acacia aneura* tall open shrubland (4 – 6 m) over *Grevillea nematophylla* subsp. *nematophylla, Phebalium filifolium, Philotheca brucei* subsp. *brucei, Exocarpos aphyllus, Prostanthera grylloana and Dodonaea lobulata, Eremophila clarkei* shrubland<br>Other species: *Acacia tetragonophylla, A. ramulosa* var. *ramulosa* | |
| **Existing track – partly overgrown** | **303584/ 6655151** |
| Recent and historic disturbances | |
| Opportunistic records<br>Perennials*: Radyera farragei, Solanum plicatile, Ptilotus obovatus, Salsola australis,*<br>*Annuals: Euphorbia drummondii, Salvia verbenaca** (Wild sage), *Vittadinia dissecta var. hirta, Cucumis myriocarpus**, unidentified grass tussocks – grazed | |

| **Relevé 06/ 07** | **303628/ 6655098 – 303650/ 6655118** |
|---|---|
| Low stony rise; ironstone gravel surface rock; indications of sheet erosion; historic disturbances – mining exploration and more recently cattle and donkeys<br><br>Condition: mostly very good |  |
| *Eucalyptus oleosa, Allocasuarina dielsiana, Casuarina pauper* open woodland to isolated trees over *Allocasuarina dielsiana, Acacia tetragonophylla, A. aneura, A. burkittii, Alectryon oleifolius subsp. canescens, Santalum spicatum* tall open shrubland (with denser patches) over *Dodonaea lobulata, Acacia tetragonophylla, Scaevola spinescens, Acacia burkittii* open shrubland over *Ptilotus obovatus, Solanum plicatile* low sparse shrubland | |

## Appendix 5: Bray-Curtis analysis of sites in the proposal



## Appendix 6: Bray-Curtis analysis comparing the proposal sites with DPAW Greenstone range surveys



## Appendix 7: Conservation codes for Western Australian flora and fauna (DBCA 2019)

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

# CONSERVATION CODES

## For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

**The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*.**

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

**T** **Threatened species**

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

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

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

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

**CR** **Critically endangered species**

Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

**EN** **Endangered species**

Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

**VU** **Vulnerable species**

Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

## Extinct species

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

**EX** **Extinct species**

Species where *"there is no reasonable doubt that the last member of the species has died"*, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

**EW** **Extinct in the wild species**

Species that *"is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form"*, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

## Specially protected species

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

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

**MI** **Migratory species**

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

**CD** **Species of special conservation interest (conservation dependent fauna)**

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

**OS** **Other specially protected species**

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

## P Priority species

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

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

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

### 1 Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

### 2 Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

### 3 Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

### 4 Priority 4: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.
(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.
(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

[1] The definition of flora includes algae, fungi and lichens
[2] Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

**Last updated 3 January 2019**

## Appendix 8: Corresponding vegetation Communities described by Outback Ecology Services (2003) as reported in PLEC 2015.

| OES 2003 | JBBC 2019 | Description |
|---|---|---|
| 1a | 6 | Open mixed woodland of *Eucalyptus lesouefii, E. griffithsii* and *Casuarina pauper* over an open mixed shrubland of *Dodonaea lobulata, Atriplex nummularia* and *Ptilotus obovatus* |
| 1c | 1, 2, 3, 4, 5 | Open woodland of *Eucalyptus griffithsii* over open shrubland *of Acacia burkittii* and *Acacia hemiteles* over a mixed shrubland understorey. (This vegetation community varied in regard to the density and diversity of the understorey across the surveyed area.) |
| 1d | 1 | Open woodland of *Eucalyptus griffithsii* over an open mixed *Acacia shrubland* of *Acacia burkittii, Acacia murrayana* and *Acacia tetragonophylla* over an open hummock grassland of *Triodia scariosa* |
| 2c | 1 | Woodland of *Acacia aneura* with a limited understorey |
| 3a | 6 | Open woodland of *Casuarina pauper* over an open understorey of *Acacia murrayana* and *Dodonaea lobulata* |

# Attachment B

## Targeted Fauna Survey - Siberia Operations Area
## Biostat Pty Ltd (2019)

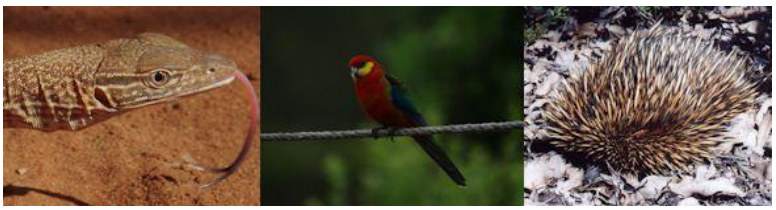
# Vegetation Clearing - Fauna Assessment

## (Davyhurst, Callion, Waihi, Siberia, Riverina Clearance Areas)

**Prepared for: Ora Banda Mining**

**By BIOSTAT Pty Ltd**

***March 2020***



# BIOSTAT Pty Ltd


ABN 87 092 767 032
39 Doris St
North Perth Western Australia 6006
Ph: +61 8 6460 2455
www.biostat.com.au consulting@biostat.com.au

## REVISION SCHEDULE

| Rev. No. | Date | Description | Prepared/Approved By |
|---|---|---|---|
| **A** | 19/2/2020 | Draft provided as starter for Leanne. Does not include Davyhurst or discussion. | EGC |
| **1** | 6/3/2020 | Final report | EGC |
| **2** | | Includes changes to Riverina boundaries and review of comments | EGC |
| | | | |
| | | | |
| | | | |

### STATEMENT OF LIMITATIONS

This report and the associated services performed by BIOSTAT Pty Ltd were undertaken to satisfy the requirements of Ora Banda Mining (the 'Client') as set out in the scope of services defined in the contract agreed to between BIOSTAT Pty Ltd and the Client. That scope of services was defined by the Client's requests, by the time and budgetary constraints imposed by the Client, the availability of information and by the availability of access to the site defined by the Client.

BIOSTAT Pty Ltd derived the data in this report primarily from site observations, information provided by the Client and an examination of records in the public domain as described in the scope of services. The passage of time, manifestation of latent conditions, additional information or impacts of future events may require further consideration of the Project and its scope and may require further subsequent data analysis and re-evaluation of the findings, observations and conclusions expressed in this report.

BIOSTAT Pty Ltd has relied upon and presumed accurate certain information (or absence thereof) relative to the site provided by government officials and authorities, the Client and others identified herein, in the preparation of this report. BIOSTAT Pty Ltd has not attempted to verify the accuracy or completeness of any such information except where stated otherwise in this report.

No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data findings, observations and conclusions are based solely upon site conditions and information provided by the Client at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client and is subject to and issued in connection with the provision of the agreement between BIOSTAT Pty Ltd and the Client. BIOSTAT Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

(The 'Project' is defined as the scope of services as set out in the contract and agreed to by BIOSTAT Pty Ltd and the Client.)

# TABLE OF CONTENTS



# TABLE OF FIGURES

## TABLE OF TABLES

# 1 INTRODUCTION

Biostat Pty Ltd (Biostat) was engaged to undertake a fauna habitat assessment as part of a vegetation clearing submission of five Ora Banda Mining Pty Ltd (OBM) leases located in the northern Goldfields, Western Australia approximately 110km north-west of Kalgoorlie (Figure ); Riverina, Davyhurst, Waihi, Callion, Siberia (Figures 2 – 5, respectively). Each of these Investigation Areas (IA) contain historical mine workings, including 19$^{th}$ and early 20$^{th}$ century prospecting shafts and working, larger more modern mine voids and associated infrastructure and areas of native vegetation of varying quality. These areas are also within pastoral leases many of which are still operating. These IAs represent the area of interest for clearing but do not denote the total area proposed for clearing. Within each area, smaller areas (disturbance envelopes) will be identified for clearing and development. Overall, these 5 areas represent a total 1,482.8 ha, and includes areas already cleared, pasture lands, and existing mine voids.

The focus of this study was to investigate the likelihood of malleefowl (*Leipoa ocellata*) occurring in these areas and the value of the vegetation delineated for clearing to this species. However, the investigations also required an assessment of habitats and their value to fauna in general. Formally, the objectives for this study:

- Undertake a visual inspection of areas identified for vegetation clearing and determine quality of habitat for malleefowl.
- Assess the quality of habitat for any other threatened species that is likely to occur in the area.
- Report on the findings from the survey and produce likelihood of occurrence tables for threatened species.

The sites are located in the confluence between Coolgardie and Murchison bioregions (V7, Thackway & Cresswell 1995) with Siberia, Waihi and Callion in the former, and Davyhurst and Riverina in the latter. The Murchison region is regarded as being under-represented in conservation areas, i.e., less than 10% in protected (Cowan 2003).

# 2 METHODS

Database search from the DBCA NatureMap database and for threatened species records were undertaken using -30.03562°, 120.65771° (WGS84) as the centre point with a 39km radius buffer applied to give a search area of approximately 4,778 km$^2$. A search using the same coordinates and buffer zone was made of Matters of National Environmental Significance (MNES) (Appendix 1).

It should be noted that ecological processes and species distributions do not recognize artificial boundaries (i.e., administrative boundaries such as local government boundaries, development envelopes, etc.) and assessments are undertaken on a local and regional basis. This is an important aspect of determining the applicability of the information in relation to the landscapes being assessed.

Where available, survey reports relating to the assessment area were reviewed as background reference for this study. Other material relevant to this study were also included in the desktop assessment.

A reconnaissance of the sites was undertaken by an experienced zoologist from 9/12/2019 – 11/12/2019. The weather during the reconnaissance was generally warm although intermittent thunderstorm and rain featured on 11/12/2019.

# 3 NOMENCLATURE, TAXONOMY AND DISTRIBUTION PATTERNS

The following literature sources have been employed to discuss fauna distribution patterns and ecology in the preparation of this report:

**Birds:** Barrett et al. 2003; Johnstone & Storr 1998, 2004.

**Mammals:** Churchill 2008; Jackson & Groves 2015; eds Van Dyck, Gynther & Baker 2013; eds Van Dyck & Strahan 2008.

**Amphibians:** Tyler & Doughty 2009; Tyler & Knight 2011.

**Reptiles:** Wilson & Swan 2013.

The nomenclature in this report follows the references listed and more recent taxonomic revisions.

Species listed in this report will adhere to strict taxonomic order as outlined in the references above. The taxonomic order tends to reflect broad guild commonality between species. The more familiar alphabetical listing of species is ecologically irrelevant and hides much of this broader information.

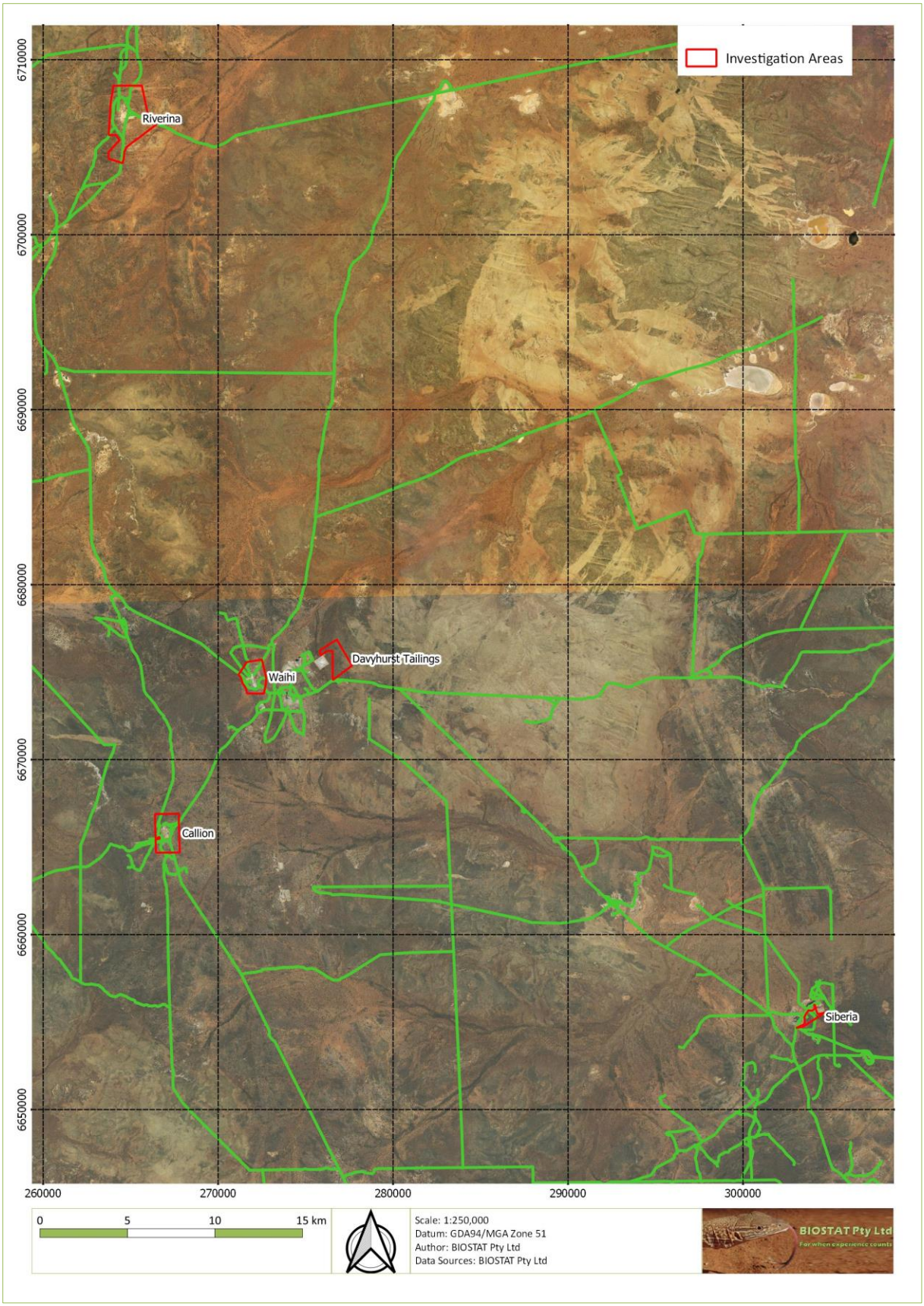



***Figure 1 Locations of investigation areas.***

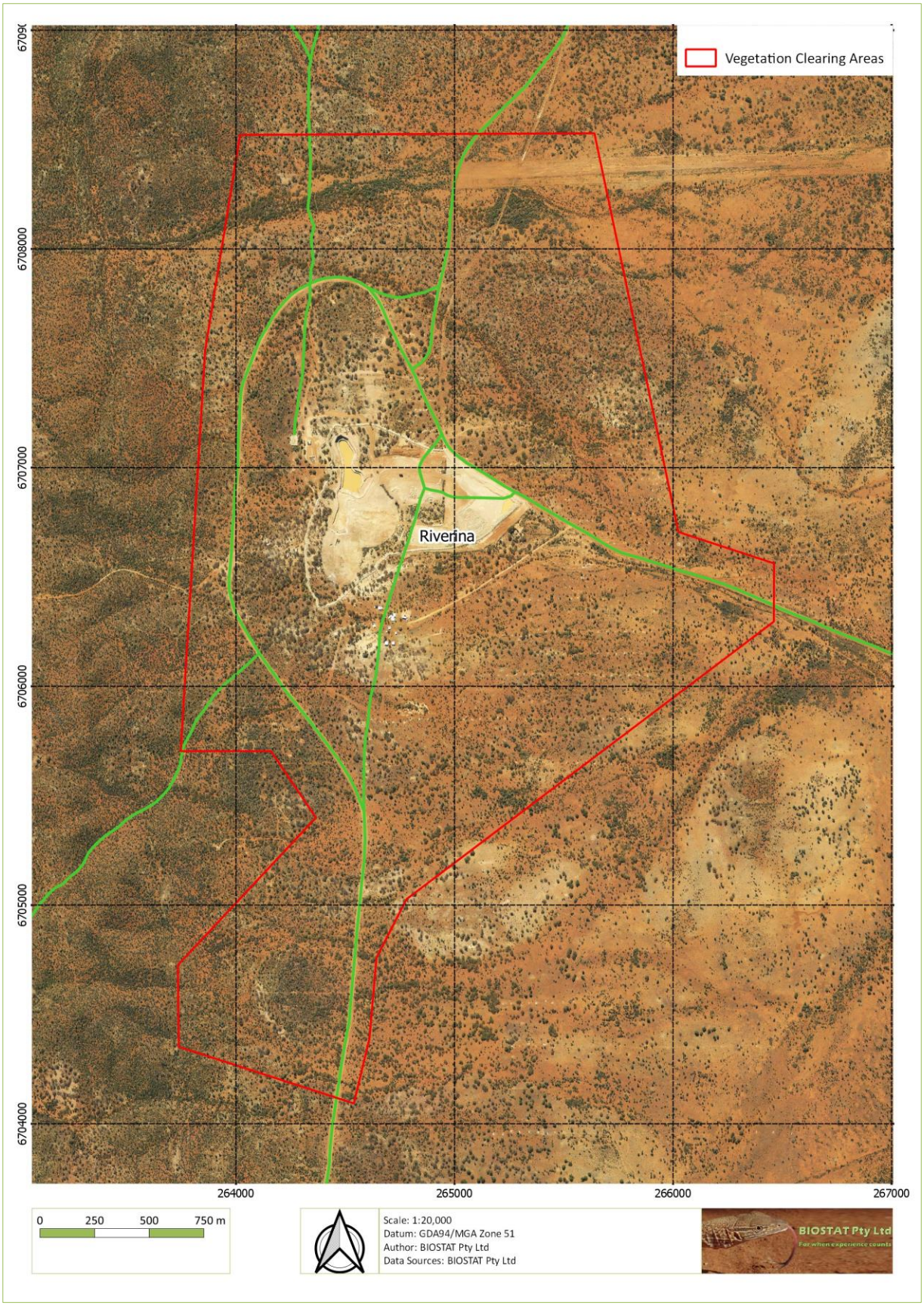



***Figure 2 Riverina investigation area.***

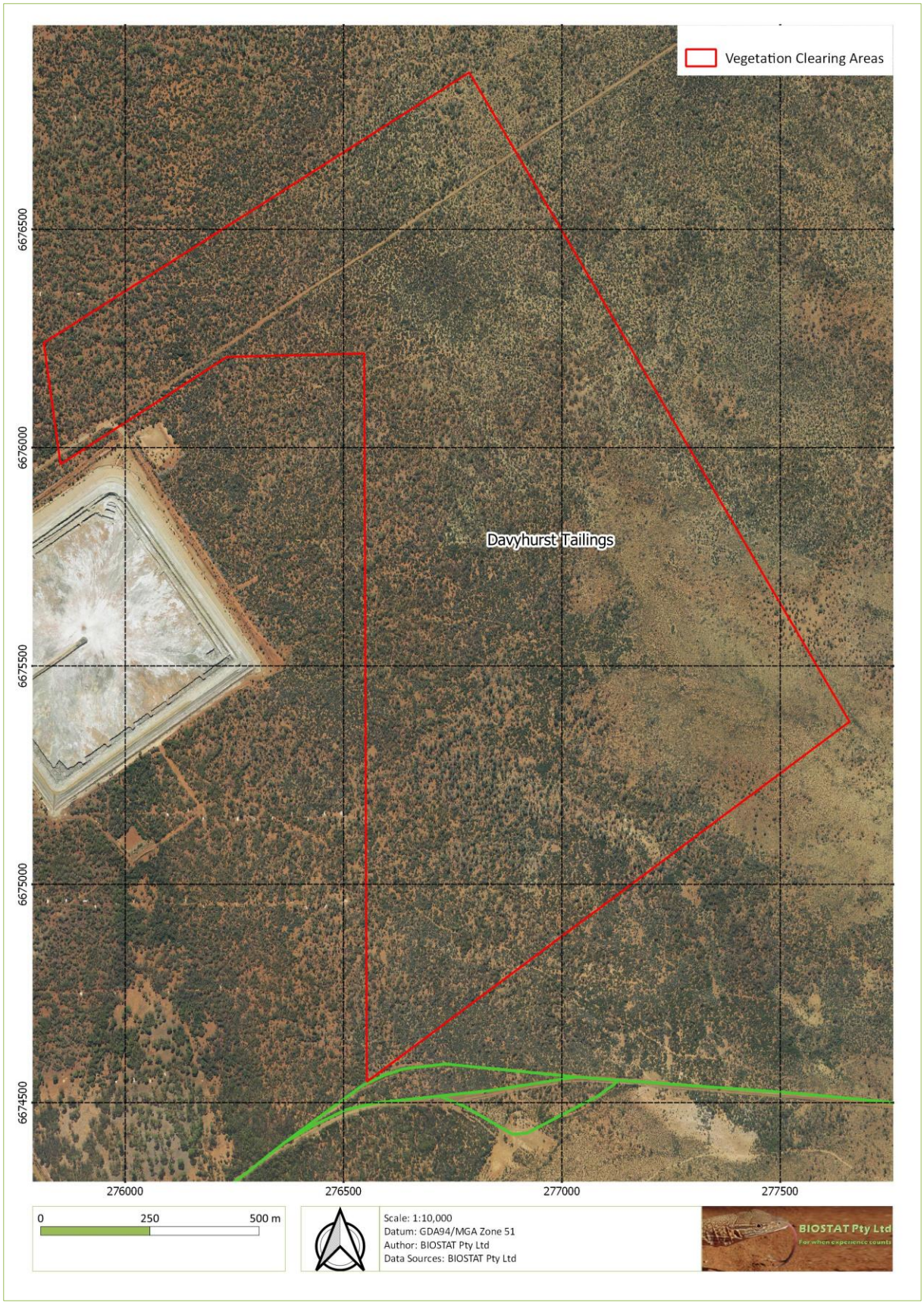



***Figure 3 Davyhurst investigation area.***

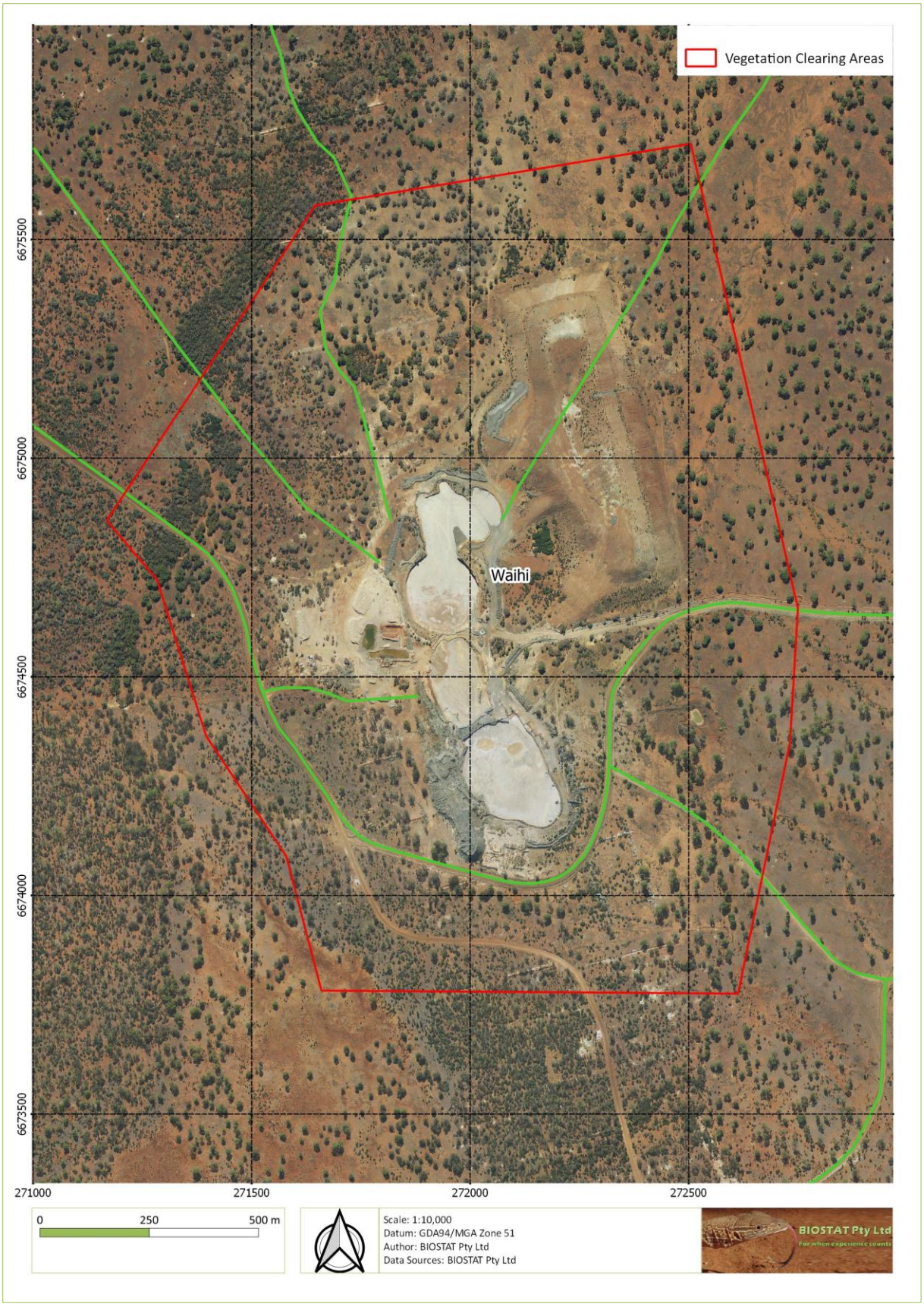



***Figure 4 Waihi investigation area.***

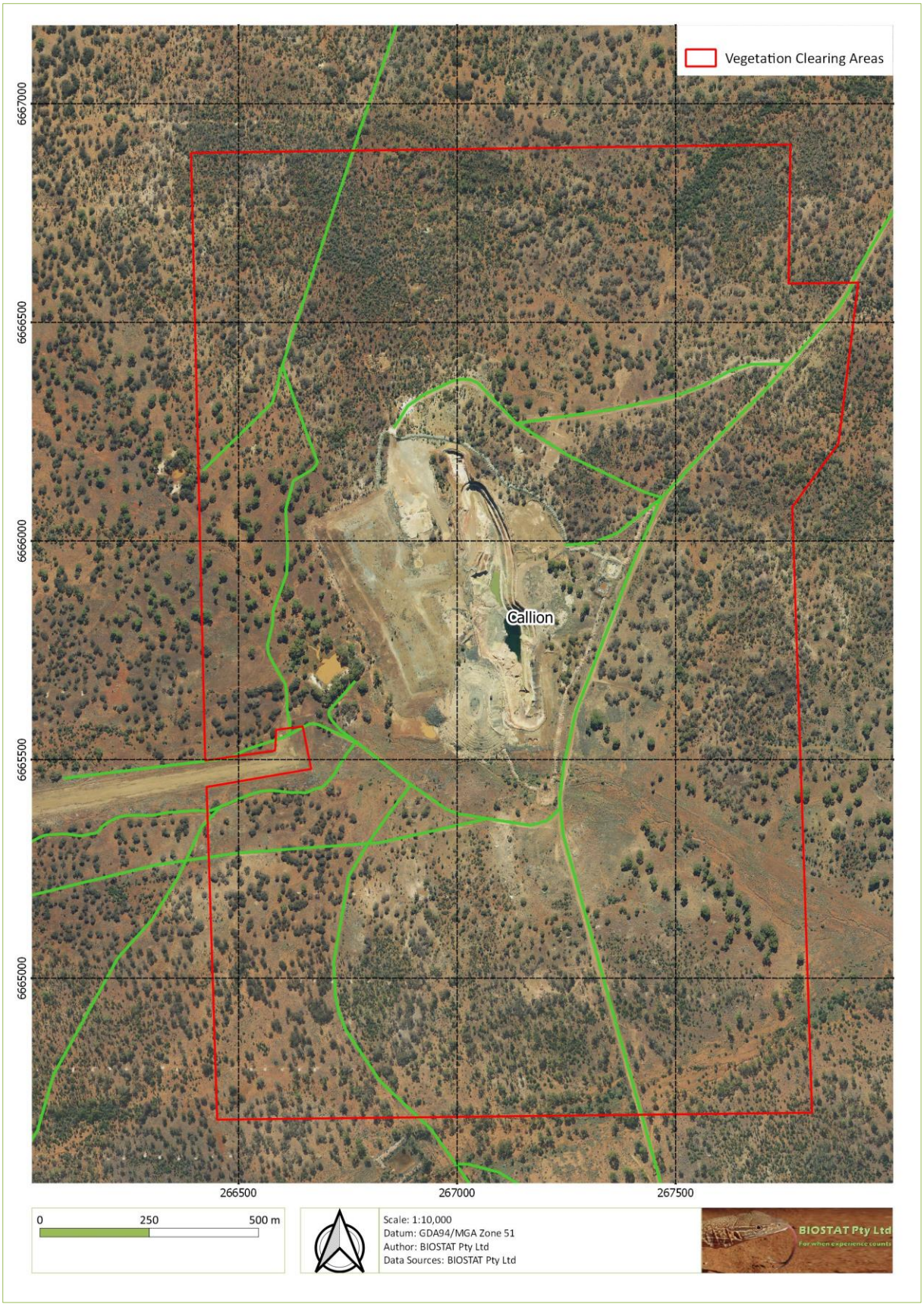



***Figure 5 Callion investigation area.***

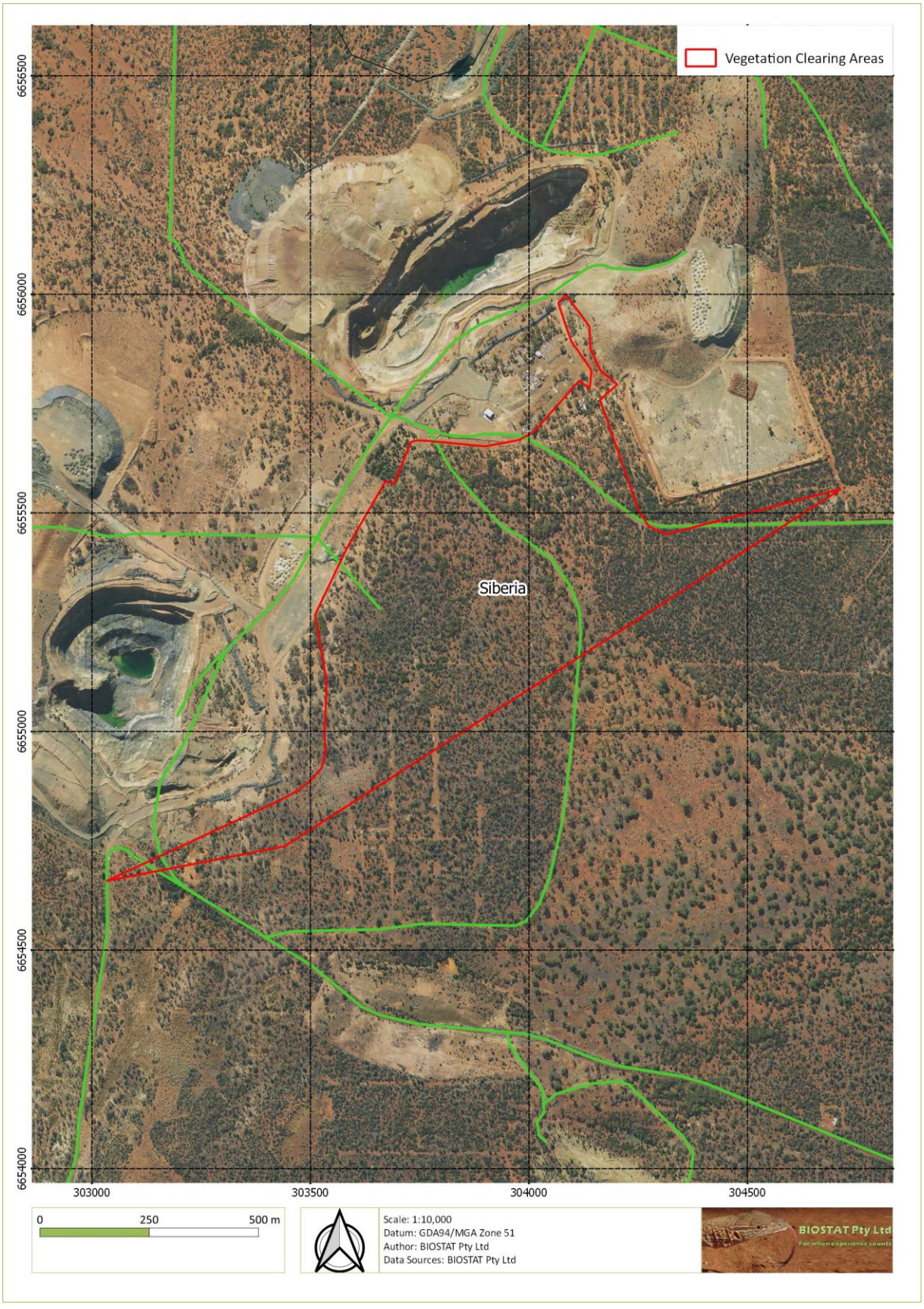



***Figure 6 Siberia investigation area.***

# 4 RESULTS AND DISCUSSION

The site reconnaissance provided an overview of the quality of habitats present in each of the areas of the project. They ecological value of habitats within areas and between areas varied from highly disturbed/poor to excellent/high. The confounding factor is the level of historical disturbance in many of these sites from mining and agricultural activities, and with the constant pressures from cattle, feral predators and herbivores.

The reconnaissance survey of Riverina and Siberia was hampered by weather events which restricted on-foot surveys due to lightning storms in the area. However, it was possibly to use existing tracks in these areas to assess habitat values.

Background material was sourced from fauna surveys undertaken in surrounding areas including Goongarrie (BIOSTAT Pty Ltd 2000) and Credo Station Reserve (Credo Station Reserve WA 2015).

The likelihood of occurrence of species is a subjective assessment reliant on an understanding of available habitat, quality of habitat, and historical and current records (Table 1). The quantification of occurrence for most species would require longer term monitoring which, in many cases, has been carried out for much of the area being assessed. Although, due to changes in species distributions brought on by climatic and habitat changes there is future possibility of species, which currently may exist on the fringes of the areas, becoming more common. The high mobility of many species of fauna, particularly migratory and nomadic birds, may require a combination of two or more categories.

This following will describe the results in two sections. The first will discuss the fauna habitat characteristics of each of the areas within the project. It will provide a preliminary determination of the quality of those habitats.

The second, will discuss the attributes of each of the species of conservation significance listed under the Federal and State government acts (see Table 2 for status descriptions) and determine their likelihood of occurrence in each of the areas.

***Table 1 Likelihood assessment categories.***

| Likelihood | Description |
|---|---|
| **Extremely Unlikely** | no suitable habitat appears to be present, the species is known to be locally extinct. |
| **Unlikely** | preferred habitat does not appear to be present, the species may be vagrant in the area. |
| **Low** | has not been recorded in the general area (i.e., within the regional search area) in the recent past but suitable viable[1] habitats are present. |
| **Moderate** | has been recorded in the general area (i.e., within the regional search area) in the past and/or preferred viable habitat is present. |
| **High** | has been recorded near or in the project area in the recent past and preferred viable habitat is present. |
| **Seasonally -high - moderate -low** | a seasonal migrant or nomadic species that has a widespread distribution and few specific habitat requirements. |
| **Recorded** | Observed during the assessment or in other surveys. |

[1] Viable habitat is defined as habitat with characteristics that would sustain a viable population of the species in the longer term (e.g., contiguous habitats vs fragmented habitats, undisturbed vs disturbed, etc.).

The database searches identified 5 MNES species; 4 bird and 1 mammal (Appendix 1). Each of these species will be considered in the following pages.

***Table 2 Conservation status codes used in text.***

| | |
|---|---|
| **Status – Australian Government (EPBC Act 1999)** | |
| **CR** | Critically Endangered |
| **EN** | Endangered |
| **VU** | Vulnerable |
| **MI** | Migratory species |
| **IA** | JAMBA, CAMBA, ROKAMBA international agreements |
| **Status – Western Australia (BC Act 2016 and DBCA Priority Listing)** | |
| **CR** | Critically Endangered |
| **EN** | Endangered |
| **VU** | Vulnerable |
| **EX** | Extinct |
| **MI** | Migratory Species |
| **CD** | Conservation Dependent |
| **OS** | Other Specially Protected Fauna |
| **XW** | Extinct in the Wild |
| **P1** | Poorly-known species with few, poorly known populations on threatened lands |
| **P2** | Poorly-known species with few, poorly known populations on conservation lands |
| **P3** | Poorly-known species with several, poorly known populations, some on conservation lands |
| **P4** | Rare, Near Threatened and other species in need of monitoring |

## 4.1 Fauna Habitat Characteristics

### 4.1.1 Riverina

The Riverina site is the largest of the areas investigated for this assessment at 614.7 ha (Figure 7). The landscape is characterised by incised low hills to the west and broad valleys and washout areas alongside broad drainage lines.

The areas bounded by the Evanston-Menzies road which include the open mine pit, station homestead and stock yards are degraded, lacking substantial understorey cover and sparse upper storey vegetation (Figure 8). Highly disturbed habitat also occurs around the airstrip at the north-eastern corner of the Riverina site. These degraded areas represent the lowest value to fauna.

Bordering the more highly disturbed habitats, and to the east of the Evanston-Menzies road, are areas of consisting of mosaics of Eucalyptus woodlands and acacia shrublands on incised drainage areas and washout slopes as well as some stony hills (Table 3). These areas are also within the field of disturbance resulting from livestock impacts and historical mining operations. However, they do represent habitats which are more structurally complex than the highly disturbed sites and, as such, are likely to provide some useful level of resource use for fauna. In total degraded areas make up approximately 76% of the land area within the clearance boundaries.

Better quality habitat exists to the west of the Evanston-Menzies road (Figure 9). It consists of a mosaic of Eucalyptus woodland on plains or stony rises, Acacia woodlands on stony rises and washouts, and shrublands on broad drainage lines. The varied topography of the area, including stony rises, incised drainage lines, washout valleys and larger drainage systems, provide the habitat variability that is likely to support a relatively higher fauna diversity. This area provides the relatively highest level of complexity in fauna habitats within the clearance envelope.

***Table 3 Fauna habitat areas identified at Riverina.***

| Fauna Habitat Code | Description | Condition | Area (ha) |
|---|---|---|---|
| **ACP** | **Acacia/Casuarina woodland on plains** | Good | 0.5 |
| | | Degraded | 83.7 |
| **ACS** | **Acacia/Casuarina on slopes** | Good | 66.9 |
| | | Degraded | 34.9 |
| **ECV** | **Eucalyptus/Casuarina woodlands in valleys** | Good | 13.5 |
| | | Degraded | 33.1 |
| **EH** | **Eucalyptus woodlands on hills** | Good | 5.0 |
| | | Degraded | 40.1 |
| **EP** | **Eucalyptus woodland on plains** | Good | 43.6 |
| | | Degraded | 139.7 |
| **SD** | **Tall shrublands on drainage lines** | Good | 17.9 |
| | | Degraded | 9.1 |
| **D** | **Degraded** | | 126.7 |
| | | *Total Degraded Area* | *467.3* |
| | | **Total Area** | **614.7** |

The Riverina investigation area was increased by approximately 104 ha after the completion of the site investigation. This was to accommodate a mine camp and access walking track of approximately 3ha. Field assessments of vegetation communities and fauna habitats for this additional area are yet to be undertaken, although it is likely that they will contain fauna habitats common to the investigation area. A field vegetation and fauna assessment are recommended prior to any ground disturbance.

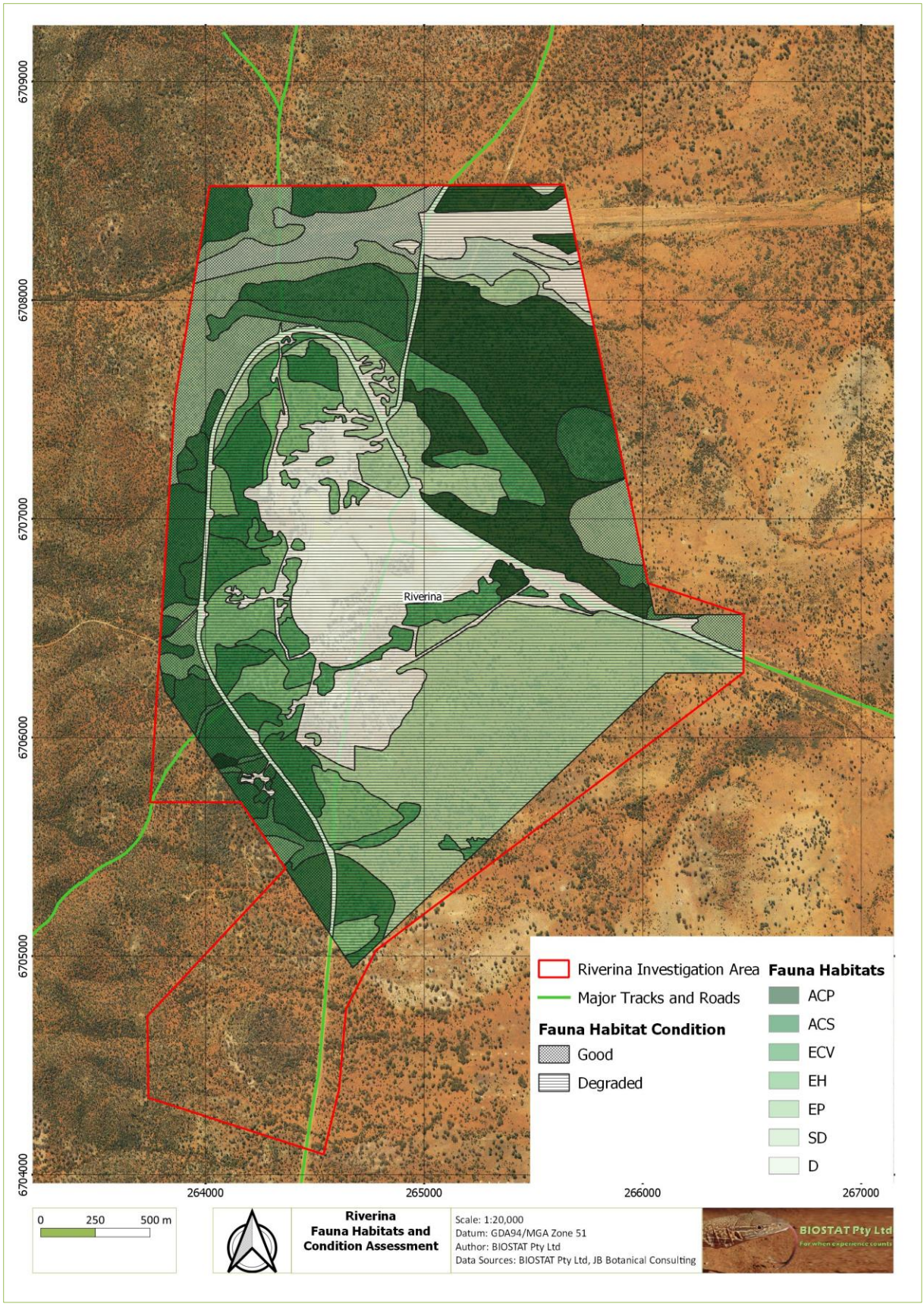



***Figure 7 Fauna habitats and condition for Riverina.***

***Figure 8 Degraded habitat showing lack of ground cover and sparse shrubs.***

***Figure 9 A more structurally complex habitat present to the west of the Evanston-Menzies road.***

### 4.1.2 Waihi

The Waihi is a highly degraded area with limited variation in fauna habitats (Table 4). Most of the site consists of lowland and washout areas of salmon gum (*Eucalyptus salmonophloia*) and gimlet (*E. salubris*) woodlands over chenopods although much of this area is considerably degraded. Impacts from mining activities, introduced grasses and weed, and the impact of cattle and other herbivores have reduced the vegetation to an open woodland system with extensive bare patches. A drainage line in the north-west corner of the IA boundary supports a variety of fauna habitats of relatively good quality although understory degradation was evident. Additional reasonably good fauna habitat exists to the west of the main access road. Waihi is overall of low-level fauna habitat quality with 88% of the area degraded to varying degrees.

The site is within a relatively degraded landscape suggesting long history of disturbance. Habitats within the greater area display similar levels of disturbance to much of Waihi clearance envelope. None of the habitats are critical to any of the listed threatened species that may occur in the local area. The loss of habitats from Waihi is likely to have minimal impact on fauna in the envelope and in surrounding areas.

***Table 4 Fauna habitat areas identified at Waihi.***

| Fauna Habitat Code | Description | Fauna Habitat Condition | Area (ha) |
|---|---|---|---|
| ASH | **Acacia shrubland** | Good | 6.8 |
| ECW | **Eucalyptus/chenopod woodland** | Good | 3.3 |
| | | Degraded | 98.4 |
| EW | **Eucalyptus woodland** | Good | 17.4 |
| | | Degraded | 28.0 |
| D | **Degraded** | | 75.6 |
| | | *Total Degraded Area* | *202.0* |
| | | **Grand Total** | **229.5** |

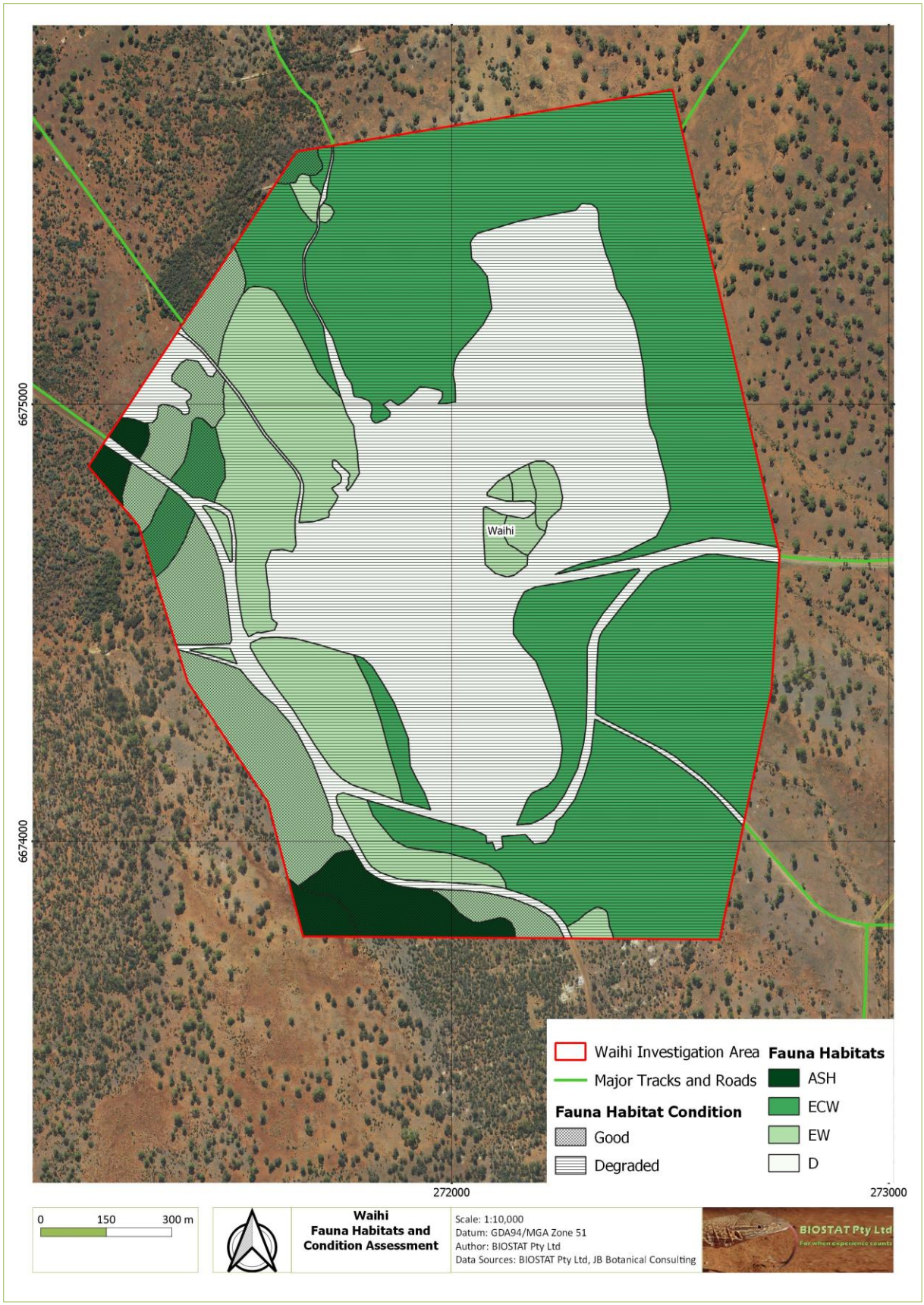



***Figure 10 Fauna habitats and condition for Waihi.***

### 4.1.3 Callion

As with Waihi, the Callion area is located on a drainage plain of sheetwash areas and drainage lines primarily of Eucalyptus woodlands over chenopods and saltbush (Figure 11). There are low rises within the landscape that support a drier habitat type of Acacia dominated shrubland or Eucalyptus dominated shrubland (Table 5). Remnant vegetation is mostly in fair condition (Figure 12). Although the vegetation is relatively dense and has an established lower storey and ground storey in patches, it was downgraded to fair due to the obvious signs of perturbations such as old mine workings and shafts as well as the persistent signs of cattle grazing impacts. The more recent mined area in the centre of the clearance envelope has changed surface water flows evident from the surface erosion to the south-east of the void.

The Eucalyptus woodlands and Acacia shrublands of the northern section do provide suitable habitat for native fauna but signs of fox were also identified during the reconnaissance. Two very old malleefowl mounds (>20 years) were located within this northern section indicating some level of suitability for nesting at some time.

***Table 5 Fauna habitat areas identified at Callion.***

| Fauna Habitat Code | Description | Fauna Habitat Condition | Area (ha) |
|---|---|---|---|
| **AS** | **Acacia shrubland** | Fair | 45.7 |
| **BR** | **Acacia shrubland on breakaways** | | 1.8 |
| **EC** | **Eucalyptus woodland over chenopods and saltbush** | | 117.6 |
| **ER** | **Eucalyptus drainage line** | | 3.3 |
| **ES** | **Eucalyptus woodland with shrubland on slopes** | | 22.6 |
| **D** | **Degraded** | | 114.2 |
| | | **Grand Total** | **305.2** |

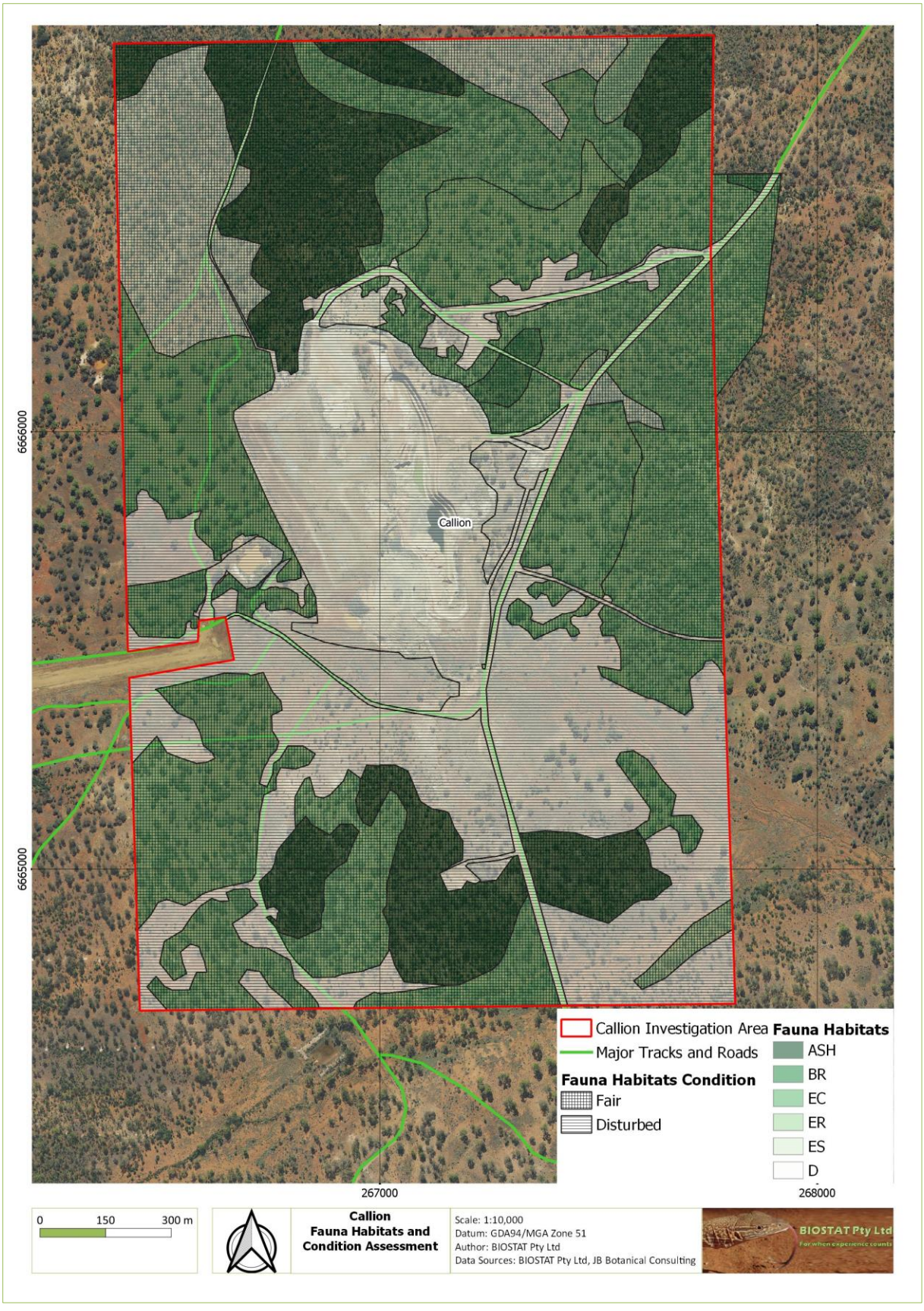



***Figure 11 Fauna habitats and condition for Callion.***

***Figure 12 Typical habitats located in Callion.***

***Figure 13 One of several fox scats located at Callion.***

### 4.1.4 Davyhurst

The Davyhurst site supports some of the higher quality habitat for any of the areas in this project (Figure 14). The habitats present in the area are all in very good condition with only very limited signs of the impact of grazing by introduced herbivores (including livestock).

The clearing area supports tall Eucalypt woodland over shrubland and tall Eucalypt mallee over spinifex or over shrubland with all forming a mosaic, transitioning from one habitat to the other (Figure 15). The Eucalypt habitat makes up 107.3 ha of the clearance area (Table 6). Certain *Eucalyptus* sp, such as *E. griffithsii* and *E. salmonophloia*, can support hollows used by birds, reptiles, and mammals. Spinifex hummock grasslands often support a very different ground-dwelling fauna assemblage in comparison to the open shrubland systems. It is likely this mosaic of systems supports a relatively high fauna biodiversity.

The complex structures created by the presence of taller trees and shrublands provide suitable nesting habitat for malleefowl. One individual was observed by an employee just outside the clearing area boundary during the reconnaissance survey and a further 5 old mounds identified within or just outside the clearance boundary.

***Table 6 Fauna habitat areas identified at Davyhurst.***

| Fauna Habitat Code | Description | Fauna Habitat Condition | Area (ha) |
|---|---|---|---|
| **CW** | Casuarina woodland | Very Good | 27.4 |
| **ML** | *Eucalyptus* sp mallee over shrubland | | 20.2 |
| **MS** | *Eucalyptus* sp mallee over spinifex | | 4.9 |
| **TE** | Tall Eucalyptus sp woodland over shrubland | | 82.2 |
| **SH** | Shrubland | | 34.3 |
| | | *Degraded* | *0* |
| | | **Grand Total** | **169.1** |

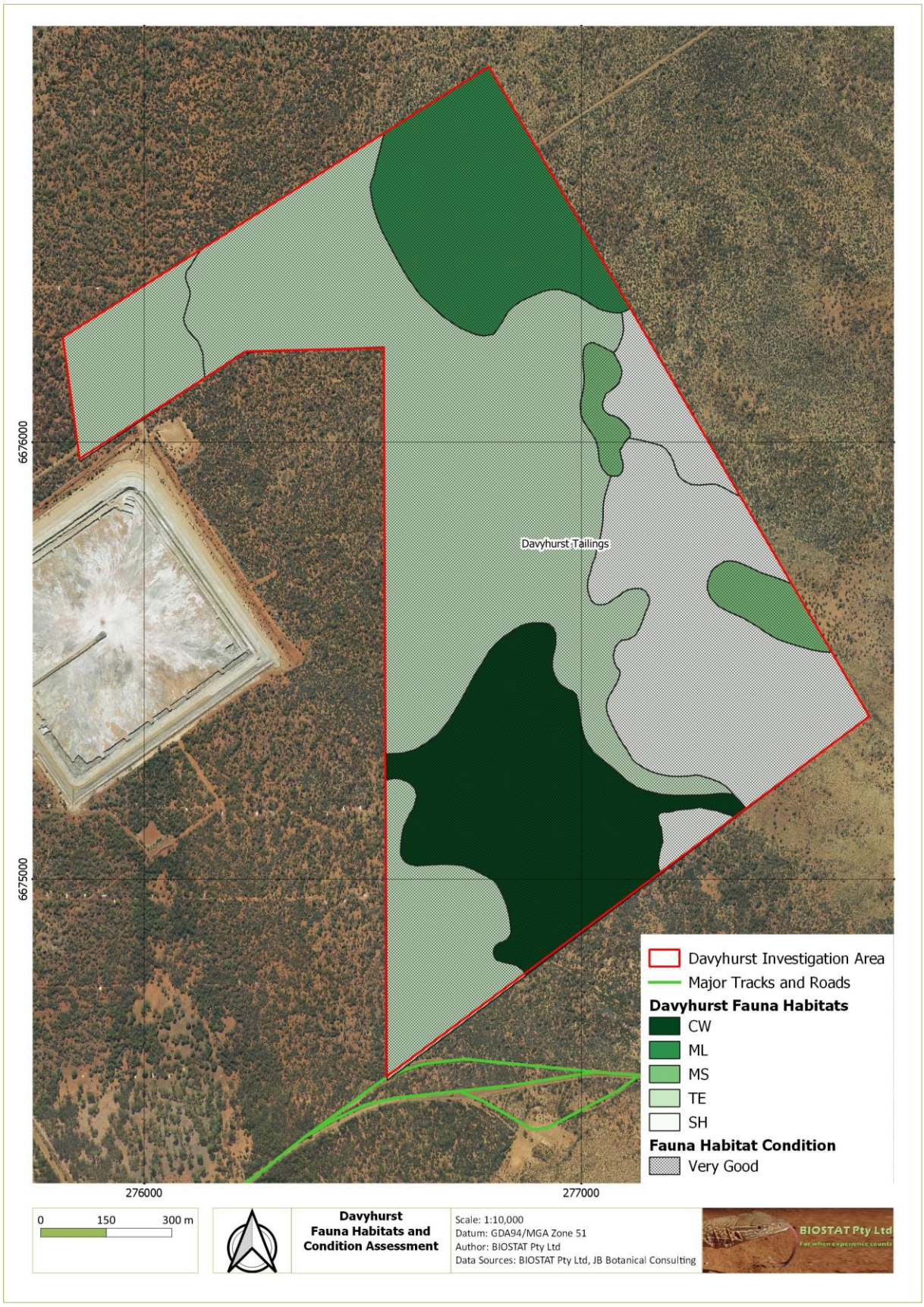



***Figure 14 Fauna habitats and condition for Davyhurst.***

***Figure 15 Typical habitats found within Davyhurst.***

### 4.1.5 Siberia

The Siberia area is located to the south of the other sites and is closer to settlement of Ora Banda. The area identified for clearing is approximately 52.1 ha in size consisting of four identifiable fauna habitats and highly degraded areas (Table 7).

The area is dominated by two topographical characteristics: Eucalyptus/mulga woodlands located on small stony rises and Eucalyptus woodlands on medium to heavy clay sheetwash plains. The stony rises support a different substrate which is likely to benefit a slightly different faunal assemblage to that found on the plains. For the most part, differences are likely to exist in ground dwelling fauna between the two topographic areas. Similarly, the taller trees are more likely to be found on the plains and these are more likely to support hollow nesting bird species. Generally, the fauna likely to be found in this area is not restricted to any specific habitat type and is likely to be found in most.

The area is highly disturbed across all habitat types. There is substantial fragmentation with haul roads and tracks throughout. There is substantial level of infrastructure still in place in the area and combined with the presence of tracks/roads, the area is likely to support the cat and fox including providing denning sites for these species. The quality of habitat in the Siberia area was judged overall as degraded and less likely to support a high degree of biodiversity, including MNES species.

***Table 7 Fauna habitats identified in Siberia***

| Fauna Habitat Codes | Description | Fauna Habitat Condition | Area (ha) |
|---|---|---|---|
| **EH** | **Eucalyptus woodland over shrubs on low stony/rocky hills** | Degraded | 12.3 |
| **EMH** | **Eucalyptus mallee over shrublands on low stony hills** | Degraded | 21.1 |
| **EP** | **Eucalyptus woodland over low shrubs on sheetwash plains** | Degraded | 13.3 |
| **MH** | **Mulga woodland on low stony hills** | Degraded | 0.7 |
| **D** | **Degraded/ cleared areas with some regrowth** | Degraded | 4.7 |
| | | **Grand Total** | **52.1** |

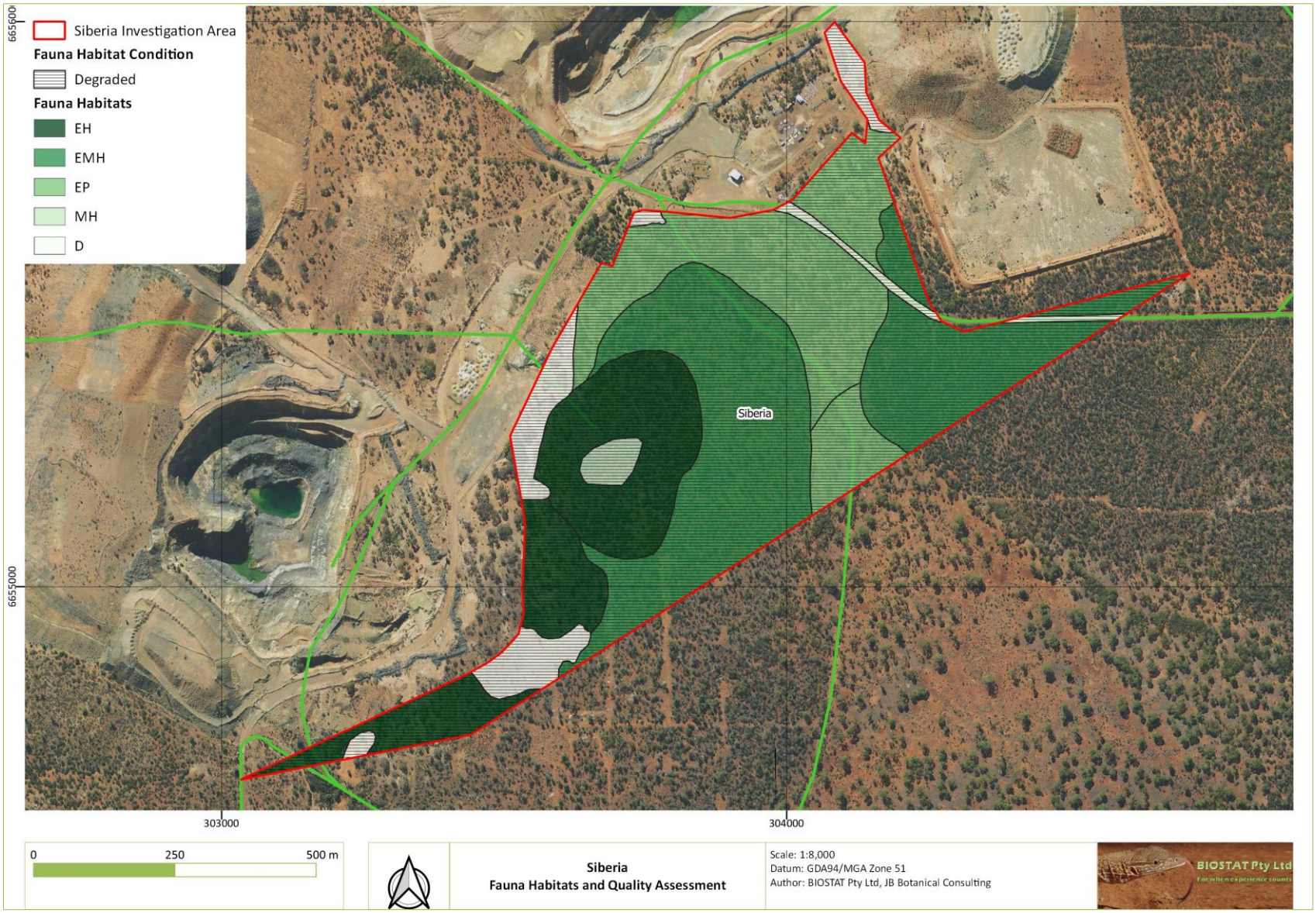



***Figure 16 Fauna habitats and condition for Siberia.***

## 4.2 MNES Species

### 4.2.1 *Leipoa ocellata*, malleefowl

**Status:** VU, VU (EPBC and BC WA respectively)

**Description:** Malleefowl distributions have been generally restricted to the lower rainfall areas (<600mm isohyet) and predominantly absent from the higher rainfall areas (Saunders & Ingram 1995). Malleefowl have been impacted by loss of habitat and introduced predators, specifically fox, *Vulpes vulpes* (Bode & Brennan 2011; Priddel, Wheeler & Copley 2007). The loss of habitats, as with all fauna species under review here, is the major impact. Malleefowl also show a preference for long unburnt habitats with current agroforestry and fire protection practices impacting on the viability of habitats for this species (Parsons & Gosper 2011). It is likely that this species will utilise remnant vegetation corridors to allow them to move in highly modified landscapes such as agricultural areas. However, the persistence of this species in modified environments and in habitats not previously associated with their biology suggests a level of resilience.

The species will utilise broad habitats including shrublands, forests and woodland systems. It is a long-lived (~30 years) mobile species with a relatively large home range. However, there is a degree of fidelity to suitable nesting habitat and they may build several mounds as part of the breeding season but will only lay and tend one "chosen" as suitable by the breeding pair. Being a long-lived species, the study of this species requires long-term data collection to provide confidence in results. They are a relatively difficult species to observe and their presence is often only recorded by the location of nesting mounds. More intensive forms of surveying for malleefowl are available, for example, transect searches or lidar analysis. In all cases they are logistically complicated requiring large teams over long periods, are technically complex, and all are relatively costly. These methods are best employed where there is a need to identify and define populations within areas and are not appropriate for this level of assessment requested for this project.

The species is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) and Schedule 3 of the Western Australian *Biodiversity Conservation Act 2016* (*BC Act*).

Sightings of malleefowl in the broader area were compiled from a search of the DBCA threatened species database and Atlas of Living Australia online database (Figure 18). The data resulting from the searches does not provide additional information relating to each record displayed on the map such as the type of observation (individual, mound or sign).

The searches of Davyhurst and Callion did locate nesting mounds (Figure 17) and an individual malleefowl was observed at Davyhurst by one of the mine personnel during the reconnaissance. All the mounds had not been used in the last 20 years and were showing signs of erosion and some were characteristic extinct mounds (i.e., >50 years of age) and had almost eroded completely. Foot searches of Riverina could not be undertaken due to safety concerns for personnel resulting from a persistent overhead lightning storm, however detailed foot searches by the Flora survey team, which included an Arid Ecologist with extensive malleefowl experience did not locate any evidence of their presence.

However, during the survey a feral cat was sighted crossing the track near the administration building at Davyhurst. Although feral cats are not considered predators of adult malleefowl, they are known to take chicks and smaller juveniles. The presence of cattle in all areas is likely to have impacted on nesting success with cattle often disturbing mounds as well as trampling vegetation.

**Likely Habitat Use:** Open woodland, open forests, mallee, tall shrublands, rocky vegetated hills.

**Threatening Processes:** Loss of habitat. Habitat fragmentation. Predation by fox, wild dog, cat.

**Likelihood of Occurrence:** Highly Likely across all areas. An individual has been recorded at Davyhurst. The recording of mounds would suggest they are also likely to utilise less disturbed habitats for breeding.

**Data Adequacy:** Limited but sufficient for assessing the likelihood of occurrence of this species on a broader scale.

***Figure 17 Old malleefowl mound located at Callion.***

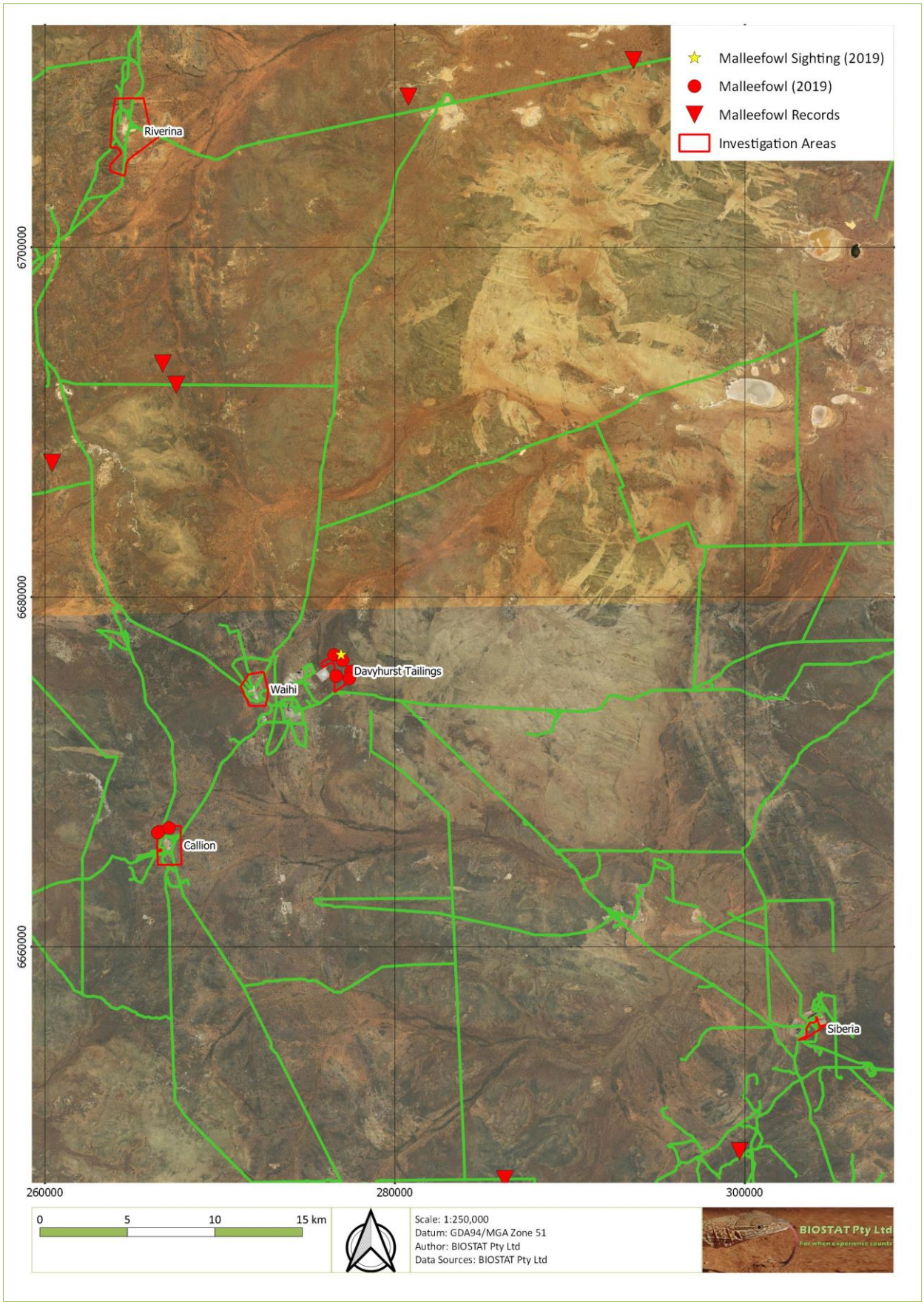



***Figure 18 Records of Malleefowl with dates of records.***

### 4.2.2 *Calidris ferruginea*, curlew sandpiper

**Status:** CR/MI, CR
**Description:** The curler sandpiper is associated with coastal mudflat areas but can sometimes be observed at inland ephemeral lakes (fresh or saline).

The species are under threat resulting from impacts on their coastal inter-tidal habitats in both the southern and northern hemispheres. They are regarded as vagrant in the interior and will utilise water bodies as short-term roosting areas (Garnett, Szabo & Dutson 2011). However, these are transient species and unlikely to be resident and their potential use of the project area habitats would be regarded as opportunistic.

No suitable habitat for this species was encountered during the reconnaissance survey. It is likely to only ever be observed as a vagrant to each of the five sites investigated, possibly as a result of being blown off course by storms.

**Likely Habitat Use:** Large open water sources and riparian systems.

**Threatening Processes:** Loss of habitat. Habitat fragmentation. Predation by cat, fox, dog, rat.

**Likelihood:** Unlikely in all areas. Transient and opportunistic.

### 4.2.3 *Pezoporus occidentalis*, night parrot

**Status:** EN, CR
**Description:**

The night parrot has only recently been "rediscovered" through its historical distribution. It prefers areas of large spinifex hummocks in long unburnt grassland habitats. Recent sightings of this species suggest that they have a broader habitat preference including chenopod shrublands (Gailberger 2017; Hamilton et al. 2017; Murphy et al. 2017).

The night parrot is a cryptic species and nomadic associated with changes in availability in water and food resources (Garnett, Szabo & Dutson 2011). It is often encountered opportunistically. Due to its enigmatic nature, surveying for this species is difficult, relying on the use of audio-recording devices established in suitable habitats over a lengthy period (10-12 months).

Much of the spinifex grassland plains encountered in the assessment consisted of small clumping *Triodia* species rather than the large hummocks more commonly associated with Night Parrot habitat. The most likely habitat for this species occurs in the eastern portions of Davyhurst which is a mosaic of tall mallee over shrubs or spinifex with areas of low shrubland with spinifex. These areas provide cover but also a foraging source for this species. Other areas of suitable habitat exist at Riverina on the western and northern fringes of the clearance area. The vegetation complexes at Callion may prove suitable for foraging for this species.

**Likely Habitat Use:** Open woodlands with relatively dense hummock and tussock grasses understorey, chenopod shrublands, salt-lake fringes, spinifex shrublands. Long unburnt habitats.

**Threatening Processes:** Loss of habitat. Habitat fragmentation. Changes in fire regimes. Introduced herbivores (cattle and other feral herbivores). Predation by cat, fox, dog.

**Likelihood:** Low in all areas. Nomadic.

### 4.2.4 Polytelis alexandrae, princess parrot

**Status:** VU, P4

**Description:** Princes Parrots are considered as an eruptive species with population numbers increasing rapidly during favourable seasons (Pavey et al. 2014). Habitat preference is for open woodlands of marbled gum (*Eucalyptus congylocarpa*), river red gum (*E. camaldulensis*) and desert oak (*Allocasuarina decaisneana*), and mallee over spinifex.

This species is restricted to the central arid interior of South Australia, Northern Territory and Western Australia. It is unlikely to be recorded in any of the project areas.

**Likely Habitat Use:** Open woodlands over spinifex and mallee over spinifex in the arid interior.

**Threatening Processes:** Changes in fire regimes, habitat clearing and fragmentation, introduced predators and herbivores.

**Likelihood:** Unlikely.

### 4.2.5 *Dasyurus geoffroii*, chuditch

**Status:** VU, VU

**Description:** This species had a much greater pre-European settlement distribution across Australia including the semi-arid and central regions (Woinarski, Burbidge & Harrison 2014). The chuditch suffered a sharp decline with the clearing of habitat and the introduction of herbivores and predators and is restricted to south-west Western Australia although it has been reintroduced into several sites across South Australia, New South Wales and Victoria. Translocations and reintroductions have also been undertaken in Western Australia with a focus to extend the current range of this species into semi-arid areas such as Lorna Glen in the Murchison district (Morris et al. 2015).

Historical records exist from the eastern portion of the Greater Western Woodlands and Goldfields region. There is also an unverified sighting of chuditch from the Goongarrie area from 2008 (NatureMap search 24/1/2020: source Record ID 15808). Much of the habitats that supported these species in the past has been highly modified or cleared. If they have persisted, the species is likely to be found in very low densities.

**Likely Habitat Use:** Woodland systems with well-established understory.

**Threatening Processes:** Habitat clearing and fragmentation, changed fire regimes, introduced predators and herbivores.

**Likelihood:** Unlikely.

# 5 GENERAL CONCLUSIONS AND RECOMMENDATIONS

The reconnaissance survey provided an overview of the fauna habitats present at each of the areas identified for clearing. It also provided a brief assessment of habitat values in relation to threatened fauna, especially malleefowl.

All the areas visited showed some degree of anthropogenic disturbances in the form of historical mine operations. Some of these mine workings were at least 90 years or older, with lower levels of associated impact. The more modern workings were on a larger scale and had more noticeable and extensive impacts.

With few exceptions the impact of livestock was also noticeable through the presence of individuals or signs such as footprints, scats and trampling of vegetation. The survey also located evidence of introduced predators including fox and feral cat. These existing factors will have impacted on the native fauna and on the habitats present within all sites.

The ecological value of habitats found within each of the sites are highly variable. The ecological values are a composite of the quality of habitats but also the complexity of the habitats. For example, the area chosen for clearing at Siberia is very much degraded and is of limited value for fauna. It is highly incised with tracks and earthworks highly fragmenting any remnant vegetation. In contrast, the Davyhurst area contains a variety of habitats with coherent structure and minimal fragmentation. This area was regarded as being in very good condition and likely to support a higher fauna biodiversity. Smaller section within the other areas also provide relatively good habitats for fauna. However, in all cases the area of degraded habitat comfortably exceeds any better-quality habitat.

All habitats have a value, even degraded habitats, as they provide varying levels of resources for different groups and species within fauna assemblages. The major impacts on habitats derive from:

1) total loss of habitats,

The total loss of habitats is the most immediate and severe impact. Total loss of habitat effectively ensures localised extirpation of fauna.

2) isolation of habitats,

The isolation of habitats would occur if areas are retained but surrounded by cleared landscape. These “islands”, if too small and too isolated, are likely to become less and less viable over time. It is likely this will occur in several of these projects as the areas will not be fully cleared and small stands may be retained.

3) fragmentation of habitats, and

Fragmentation of habitats occurs if areas, usually small, are randomly distributed in the landscape with some level of connectivity but not enough to provide contiguity. This impacts by reducing available viable habitat for fauna which, in turn, reduces survivability of populations.

4) secondary impacts on adjacent habitats.

Changes in habitats such as clearing will impact on surrounding habitats in a variety of ways. These are considered secondary impacts and include changes to surface hydrology, erosion, salination, silting, the creation of new edge effects, the introduction of weeds and the facilitation of access by introduced predators and herbivores.

The areas defined for clearing are likely to fall within categories 1 and 2 where the entire site is to be cleared (Siberia) or partially cleared (Riverina, Callion, Waihi and Davyhurst). It is, therefore, important the secondary impacts are avoided, mitigated or managed.

It is unlikely that clearing of Siberia will have any major secondary impacts as it supports a very low quality of habitat. Similarly, with most of Waihi also degraded, its value to native fauna is also considered low. However, it is important to consider the changes to surface hydrology at both sites as a result of clearing. This is especially important at Waihi due to the presence of the drainage line in the north-western corner of the clearing boundary. In addition, erosion and silting could be exacerbated due to the lack of vegetation cover and with changes in topography due to infrastructure.

Similarly, most of the area at Waihi has been highly disturbed and lack any coherent fauna habitat quality factors such as contiguity and structure. Areas to the north and west of the site, and adjacent areas outside the clearing envelope are of better fauna habitat quality. As with all clearing, the secondary and downstream impacts are of concern. However, in the case of the proposed clearing of Waihi, these impacts would be minimal.

Callion is in a landscape dominated by a sheetwash drainage plain with small areas of rises supporting open woodlands. The vegetation in the plains is relatively sparse but adapted to ephemeral flooding. Clearing the area is likely to impose surface hydrology impacts unless managed through the implementation of drainage mitigation measures (e.g., construction of channels, contour flow management). Other issues such as erosion and top-soil loss may also arise.

Riverina has sections of good quality habitat west and north of the Evanston-Menzies road. These are relatively intact vegetation communities on rises and along a drainage line. They are impacted by livestock and it is likely they also support introduced predators. The Evanston-Menzies road would act as a minor barrier to some of the smaller fauna (herpetofauna, small mammals, etc) but the lack of high-quality habitat to the east of the road would limit movement. The loss of the section to the west of the Evanston-Menzies road would impact on existing environment by creating a new edge-effect impact area. Furthermore, impacts on the drainage line to the north of the Evanston-Menzies road will potentially have downstream impacts outside the vegetation clearing boundaries.

The Davyhurst clearing envelope contains the largest area of very good quality habitat. The overall impact of the clearing is on adjacent habitats, mostly also of very good quality, through the creation of new edge effects, the facilitation of the movement of introduced predators (tracks), and changes in surface hydrology. These factors must be considered in the planning for the area to mitigate and manage downstream and secondary impacts.

None of the areas represent critical habitat for fauna, including malleefowl. Although an individual of this species was observed at Davyhurst, the available habitats outside the clearing areas are likely to be sufficient to support the local populations. This is especially relevant to areas such as Siberia where the habitats within the clearing envelope are degraded and unlikely to support nothing more than the occasional transient individual. The likelihood of other threatened species in the area is low. However, the cryptic and enigmatic night parrot may exist in the area, especially in the sheetwash plains of Callion and the low shrublands of Davyhurst. From available information on its biology, the habitats in these areas are not high value but mobile species can be found in many areas as transients. In summary, while most birds, larger mammals and reptiles will be able to avoid the impact of clearing, most small mammals, reptiles and burrowing frogs will be unavoidably killed by the large machinery used for vegetation removal and ground preparation. While the impact on individual animals is high, the clearing will have very little impact on the species overall.

In conclusion, none of the areas investigated are of sufficiently high quality and of importance to any of the listed threatened species for the area. In most cases, remnant habitats and areas are poor in quality and would not present a significant loss to the populations nor impact on local populations if they exist in the area. The greatest concern are secondary and downstream impacts resulting from the clearing of vegetation. It is recommended:

- The areas added to the project after the site reconnaissance should be assessed for fauna habitat and fauna quality prior to any ground disturbance.

- A search of areas to be cleared for malleefowl nests be conducted by an experienced zoologist prior to any activity.
- Avoidance of unnecessary clearing of vegetation beyond that strictly required.
- Windrows of topsoil, log debris and leaf litter formed during clearing should be retained, as they create extremely good microhabitat for a large range of fauna, particularly reptiles (see comment below).
- Rapid rehabilitation of cleared areas such as laydown sites and access tracks which are no longer required after construction.
- Rehabilitation should be structured to encourage the return of fauna by providing micro-relief and dense vegetation cover. This may be achieved, particularly in temporary laydown areas, by:
    - leaving patches or strips of vegetation;
    - placing equipment on flattened shrubbery rather than clearing;
    - retention of root stock in the ground by shallow scraping during essential clearing; and,
    - retaining stockpiled vegetation debris in windrows.
- Consideration is given to feral predator control (cat and fox) program.

Windrows and flattened vegetation provide substantial microhabitat and increased humidity for small vertebrates. They also provide a trap for windblown seed and protection for seedlings following germination. Placement of windrows across the prevailing wind direction may reduce erosion and facilitate rehabilitation success.

# 6 REFERENCES

Barrett, G, Silcocks, A, Barry, S, Cunningham, R & Poulter, R 2003, *The new atlas of Australian birds*, 2nd edn, Royal Australasian Ornithologists Union (Birds Australia), Hawthorn.

BIOSTAT Pty Ltd 2000, *Vertebrate Fauna Assessment Goongarrie Nickel Project Heron Resources NL*, Unpublished report for Mattiske Consulting Pty Ltd.

Bode, M & Brennan, KEC 2011, 'Using population viability analysis to guide research and conservation actions for Australia's threatened Malleefowl *Leipoa ocellata*', *Oryx*, vol. 45, no. 04, pp. 513–521.

Churchill, S 2008, *Australian Bats*, 2nd edn, New Holland Publishers (Australia) Pty Ltd, Sydney.

Cowan, M 2003, 'Murchison 1 (MUR1 - Eastern Murchison subregion)', in NL McKenzie, JE May & S McKenna (eds), *A biodiversity audit of Western Australia's 53 biogeographical subregions.*, Department of Conservation and Land Management, Perth, pp. 466–479.

Credo Station Reserve WA 2015, *A Bush Blitz survey report*, Bush Blitz Discovery Program, Commonwealth of Australia, Canberra, p. 74.

Gailberger, J 2017, 'Presumed extinct, night parrot colony uncovered near Lake Eyre', *The Advertiser*, 14 September, South Australia, viewed 14 September 2017, <http://www.adelaidenow.com.au/technology/science/presumed-extinct-night-parrot-colony-uncovered-near-lake-eyre/news-story/9c2c54bde6033a3f6971c5673204d661>.

Garnett, ST, Szabo, JK & Dutson, G 2011, *The action plan for Australian birds 2010*, CSIRO Publishing, Collingwood.

Hamilton, N, Burbidge, A, Douglas, T & Gilbert, L 2017, 'Piecing the puzzle together: the fate of the Night Parrot nest found in Western Australia by Jackett et al . (2017)', *Australian Field Ornithology*, vol. 34, no. 0, viewed 27 December 2017, <http://www.birdlife.org.au/afo/index.php/afo/article/view/2098>.

Jackson, S & Groves, C 2015, *Taxonomy of Australian Mammals*, CSIRO Publishing, Melbourne.

Johnstone, RE & Storr, GM 1998, *Handbook of Western Australian Birds*, vol. 1, Non-Passerine (Emu to Dollarbird), WA Museum, Perth.

— 2004, *Handbook of Western Australian birds*, vol. 2, Passerines (Blue-winged Pitta to Goldfinch), Western Australian Museum, Perth.

Morris, K, Page, M, Kay, R, Renwick, J, Desmond, A, Comer, S, Burbidge, A, Kuchling, G & Sims, C 2015, 'Forty years of fauna translocations in Western Australia: lessons learned', in DP Armstrong, MW Hayward, D Moro & PJ Seddon (eds), *Advances in Reintroduction Biology of Australian and New Zealand Fauna*, CSIRO Publishing, Clayton South, Victoria, pp. 217–235.

Murphy, SA, Silcock, J, Murphy, R, Reid, J & Austin, JJ 2017, 'Movements and habitat use of the night parrot Pezoporus occidentalis in south-western Queensland', *Austral Ecology*.

Parsons, BC & Gosper, CR 2011, 'Contemporary fire regimes in a fragmented and an unfragmented landscape: implications for vegetation structure and persistence of the fire-sensitive malleefowl', *International Journal of Wildland Fire*, vol. 20, no. 2, pp. 184–194.

Pavey, CR, Nano, CEM, Cole, JR, McDonald, PJ, Nunn, P, Silcocks, A & Clarke, RH 2014, 'The breeding and foraging ecology and abundance of the Princess Parrot (Polytelis alexandrae) during a population irruption', *Emu*, vol. 114, no. 2, pp. 106–115.

Priddel, D, Wheeler, R & Copley, P 2007, 'Does the integrity or structure of mallee habitat influence the degree of Fox predation on Malleefowl (Leipoa ocellata)?', *Emu*, vol. 107, no. 2, pp. 100–107.

Saunders, DA & Ingram, JA 1995, *Birds of Southwestern Australia*, Surrey Beatty & Sons, Perth.

Thackway, R & Cresswell, ID 1995, *An interim biogeographic regionalisation for Australia: a framework for establishing the national system of reserves*, Version 4.0, Australian Nature Conservation Agency, Canberra.

Tyler, MJ & Doughty, P 2009, *Field guide to frogs of Western Australia*, 4th edn, Western Australian Museum, Perth.

Tyler, MJ & Knight, F 2011, *Field Guide to the Frogs of Australia*, CSIRO Publishing, Collingwood.

Van Dyck, S, Gynther, I & Baker, A (eds) 2013, *Field companion to the mammals of Australia*, 1st edn, New Holland Publishers, Sydney.

Van Dyck, S & Strahan, R (eds) 2008, *The Mammals of Australia*, 3rd edn, New Holland Publishing Australia Pty Limited, Sydney.

Wilson, S & Swan, G 2017, *A Complete Guide to Reptiles of Australia*, 5th edn, New Holland Publishers (Australia) Pty Ltd, Sydney.

Woinarski, JCZ, Burbidge, AA & Harrison, PL 2014, *The action plan for Australian mammals 2012*, CSIRO Publishing, Collingwood.

# Appendix 1. Database Searches Results