



Enterprise Project

Native Vegetation Clearing Permit Application
Supporting Document

February 2024

M31/30, M31/380 and M31/381

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SUMMARY

This document has been prepared in support of an application for a native vegetation clearing permit under Section 51E of Part V of the *Environmental Protection Act 1986* (EP Act).

Northern Star (Carosue Dam) Pty Ltd (Northern Star) is seeking approval for a clearing permit to support the next phase of mining at the Enterprise Project located on mining tenements M31/30, M31/380 and M31/381.

A clearing permit was previously held for this project (CPS 4033/4), however this clearing permit expired in January 2024. Northern Star (Carosue Dam) Pty Ltd now seeks approval for a new clearing permit to reinstate clearing approval for this project.

The clearing area and amount of clearing proposed is larger than previously approved under CPS 4033/4. This is required to facilitate expansion of the Enterprise project to facilitate the next phase of mining. The nature of clearing proposed will not change.

Application Details:

Project Name: Enterprise Project

Project Location: Mining Leases M31/30, M31/380 and M31/381, located in the Shire of Menzies, approximately 130 km northeast of Kalgoorlie Boulder (Figure 1-1).

Project Purpose: Mining

Clearing area: 233 ha of clearing within a 381 ha clearing permit area

This supporting document includes a summary of the clearing proposed and an assessment of native vegetation clearing (DWER 2014):

- The proposed clearing will result in the removal of up to 233 ha of vegetation communities in Completely Degraded to Very Good condition.
- Vegetation clearing will be minimised as far as practicable during mine development. Environmental management measures will be implemented in accordance with Northern Star's environmental management systems, which includes an internal land disturbance permitting procedure, dust suppression and weed management.
- The proposed clearing is not at variance, or not likely to be at variance, with nine of the ten clearing principles.
- The vegetation clearing is **may to be at variance with principle f:** No permanent wetlands or watercourses occur within the clearing permit area. One minor ephemeral drainage intersects the clearing permit area. All vegetation within the clearing permit area, including vegetation associated with the watercourses is well represented in the region.

1 INTRODUCTION

This document has been prepared in support of an application for a native vegetation clearing permit under Section 51E of Part V of the *Environmental Protection Act 1986* (EP Act).

Northern Star (Carosue Dam) Pty Ltd (Northern Star) is seeking approval for a clearing permit to support the next phase of mining at the Enterprise Project located on mining tenements M31/30, M31/380 and M31/381.

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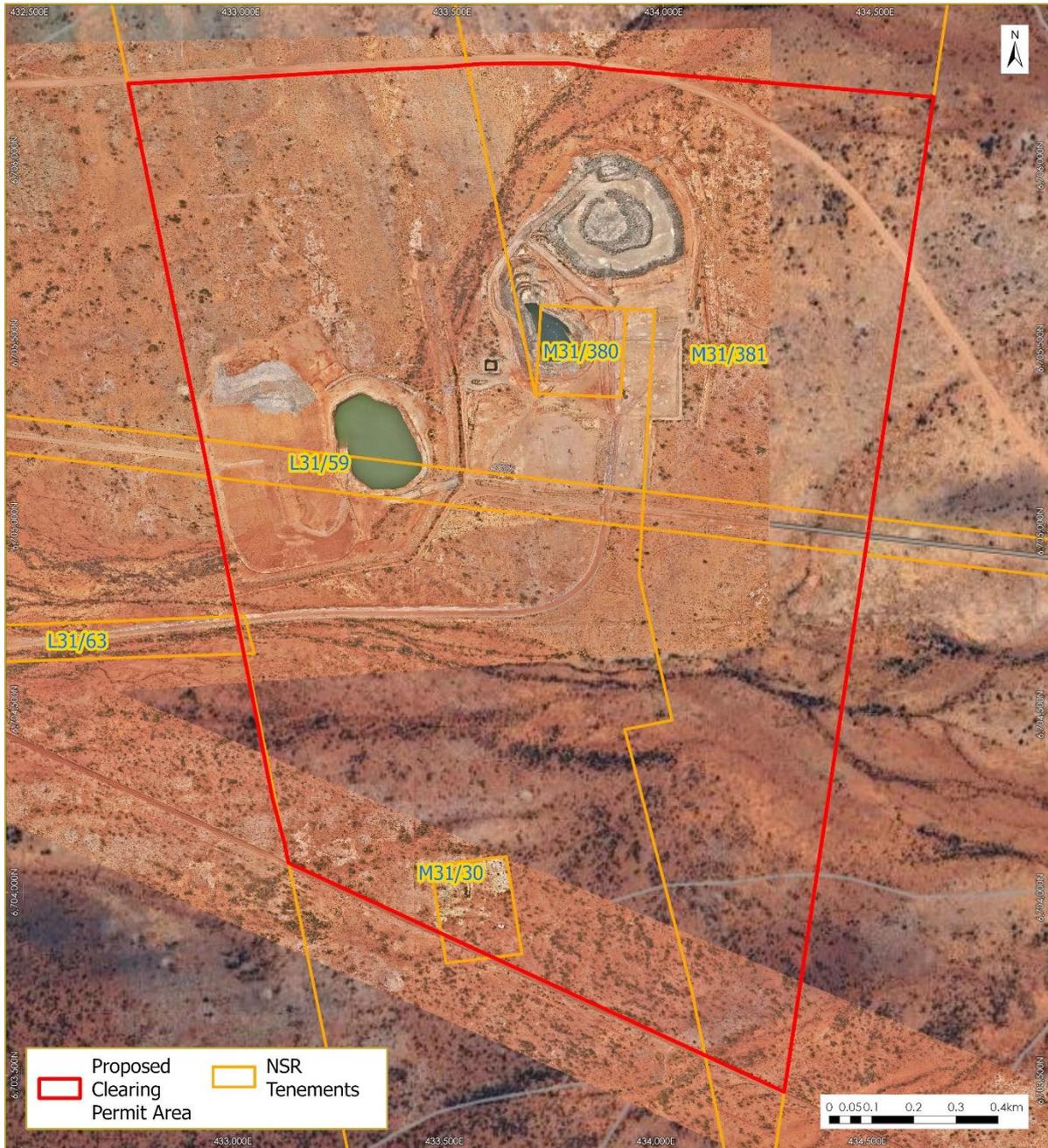


Figure 1-1: Proposed Clearing Permit Area

2 CLEARING ACTIVITIES

2.1 Historic Clearing

Enterprise was initially mined in the early 2010s, with clearing previously implemented under clearing permits CPS 2996/1 and 4033/4. Vegetation within the proposed clearing area has been historically impacted by mining and pastoralism and is currently in Completely Degraded to Very Good Condition.

2.2 Proposed Clearing

Project Name: Enterprise Project

Project Location: Mining Leases M31/30, M31/380 and M31/381, located in the Shire of Menzies, approximately 130 km northeast of Kalgoorlie Boulder (Figure 1-1).

Land Ownership: Tenements M31/30, M31/380 and M31/381 are wholly owned by Northern Star (Carosue Dam) Pty Ltd.

Other relevant tenure: Overlies Edjudina Pastoral Lease (N049971)

Zoning: Zoned under the Shire of Menzies Local Planning Scheme as Rural.

Proposed clearing: Native vegetation to be cleared includes a combination of native vegetation and previously disturbed regrowth.

Project Purpose: Mining. The next phase of mining involves expansion of the existing pits, waste rock landform and supporting infrastructure, including run-of-mine pad, Turkey's Nest, workshops and offices etc. (Figure 2-1).

Clearing area: 233 ha of clearing within a 381 ha clearing permit area

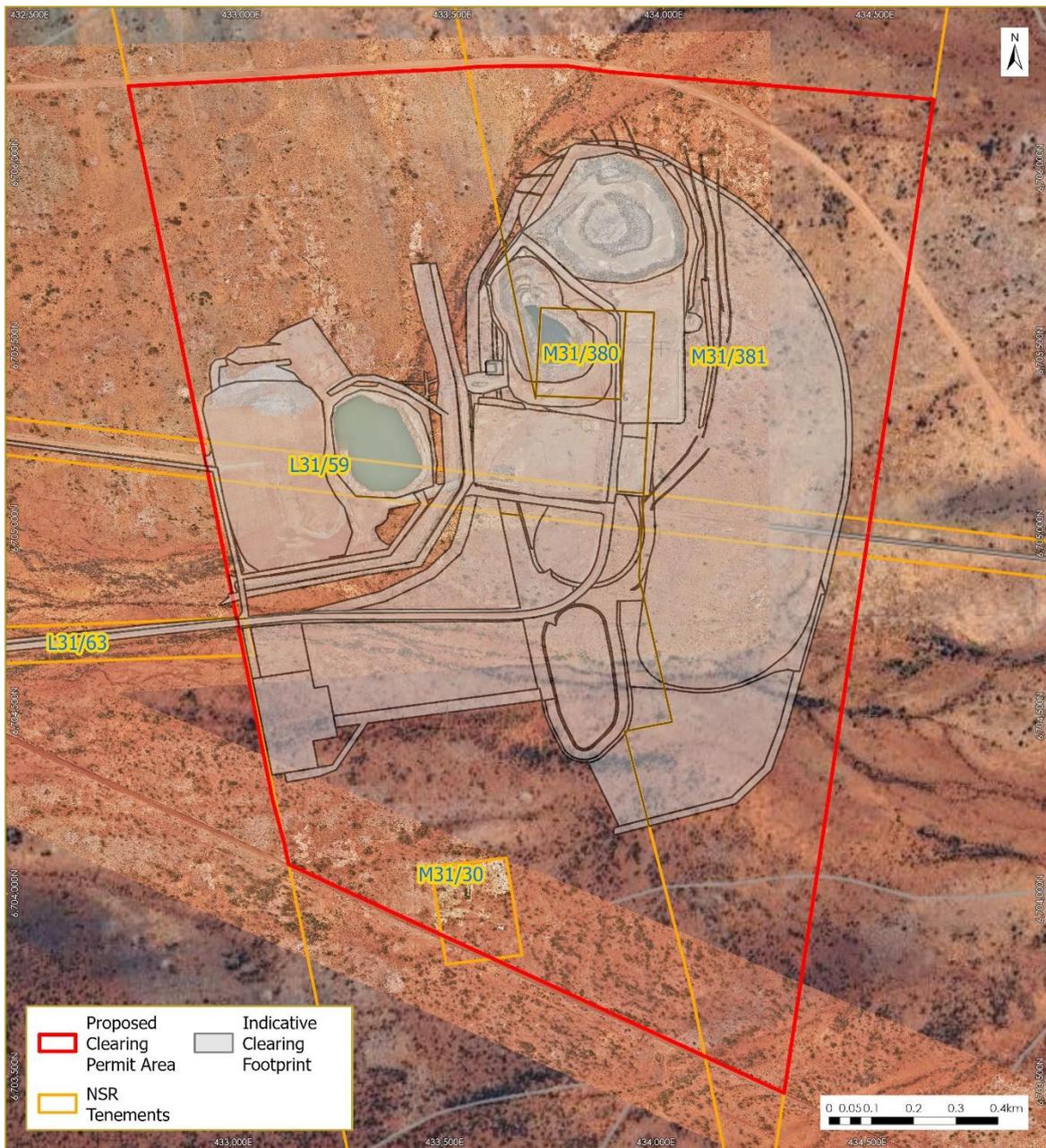


Figure 2-1: Indicative Clearing Footprint

2.3 Measures to Avoid, Minimise and Mitigate Clearing Impacts

Northern Star Resources Ltd operates on a hierarchy of avoid, minimise, rehabilitate and offset. This hierarchy is achieved primarily through changes in design during mine planning and implementation. The following considerations were made during the mine planning process.

- **Avoid** – it will not be possible to avoid the additional clearing, as additional disturbance will be required to accommodate the expanded mining infrastructure (e.g. mining void, waste rock dump etc.).
- **Minimise** – additional clearing will be minimised as far as practicable using a design that minimises lateral expansion of infrastructure (e.g. waste rock dumps) where possible. Clearing will take place progressively during implementation.
- **Rehabilitate** – native vegetation clearing will be rehabilitated in accordance with mine closure obligations under the *Mining Act 1978*. While some clearing such as that for mining voids will be permanent, other areas such as supporting infrastructure and waste rock dumps will be rehabilitated at closure.
- **Offset** – the proposed native vegetation clearing will not result in any significant residual impacts to the environment and therefore an offset is not required.

2.4 Vegetation Management

Clearing of native vegetation will be implemented in accordance with Northern Star Resources Ltd environmental management systems, which include:

- Land Disturbance permitting procedures.
- Hygiene protocols to prevent the introduction and spread of weeds.
- Harvesting and stockpiling topsoil for use in rehabilitation.
- Dust suppression to minimise erosion and loss of growth media.

3 ENVIRONMENTAL SURVEYS

3.1 Botanica (2010)

Botanica Consulting (2010) (Botanica) conducted a vegetation and flora survey of the clearing permit application area on 12 and 13 July 2010 (Appendix A).

Botanica described four vegetation communities within the proposed clearing permit area: Creepline Vegetation, *Maireana pyramidata* Chenopod Shrubland, *Maireana sedifolia* Chenopod Shrubland and Mulga Woodland. No Threatened or Priority species were identified.

Four weed species were recorded during the survey: *Carthamus lanatus* (Saffron thistle), *Citrullus lanatus*, *Salvia verbenaca* and *Lysimachia arvensis*. None of these species are currently listed as Declared weeds.

3.2 Alexander Holm and Associates (2023)

Alexander Holm & Associates (2023) (AHA) conducted a vegetation, flora and fauna survey of the clearing permit application area in October 2023 (Appendix B). The vegetation and flora survey was conducted on October 10 -11, 2023 and the fauna survey on October 27, 2023.

While flora composition and vegetation associations within the clearing permit application area are degraded, they are typical of the region and not considered unusually diverse.

Five weed species were recorded during the survey: *Citrullus amarus*, *Cenchrus ciliates*, *Malvastrum Americanum*, *Salvia verbenaca* and *Sonchus oleraceus*. None of these species are currently listed as Declared weeds

There are no Threatened Ecological Communities (TECs) and no Priority Ecological Communities within or adjacent to the survey area. No Threatened or Priority listed flora or fauna were recorded during this survey.

4 VEGETATION DETAILS

4.1 Vegetation Associations and Representation

Two pre-European vegetation associations have been mapped within the proposed clearing permit area: 389 – succulent steppe with open low woodland, mulga over saltbush; and 400 succulent steppe with open low woodland, mulga over bluebush (Figure 4-1).

Representation of these pre-European vegetation associations is summarised in Table 1.



Figure 4-1: Pre-European Vegetation Associations

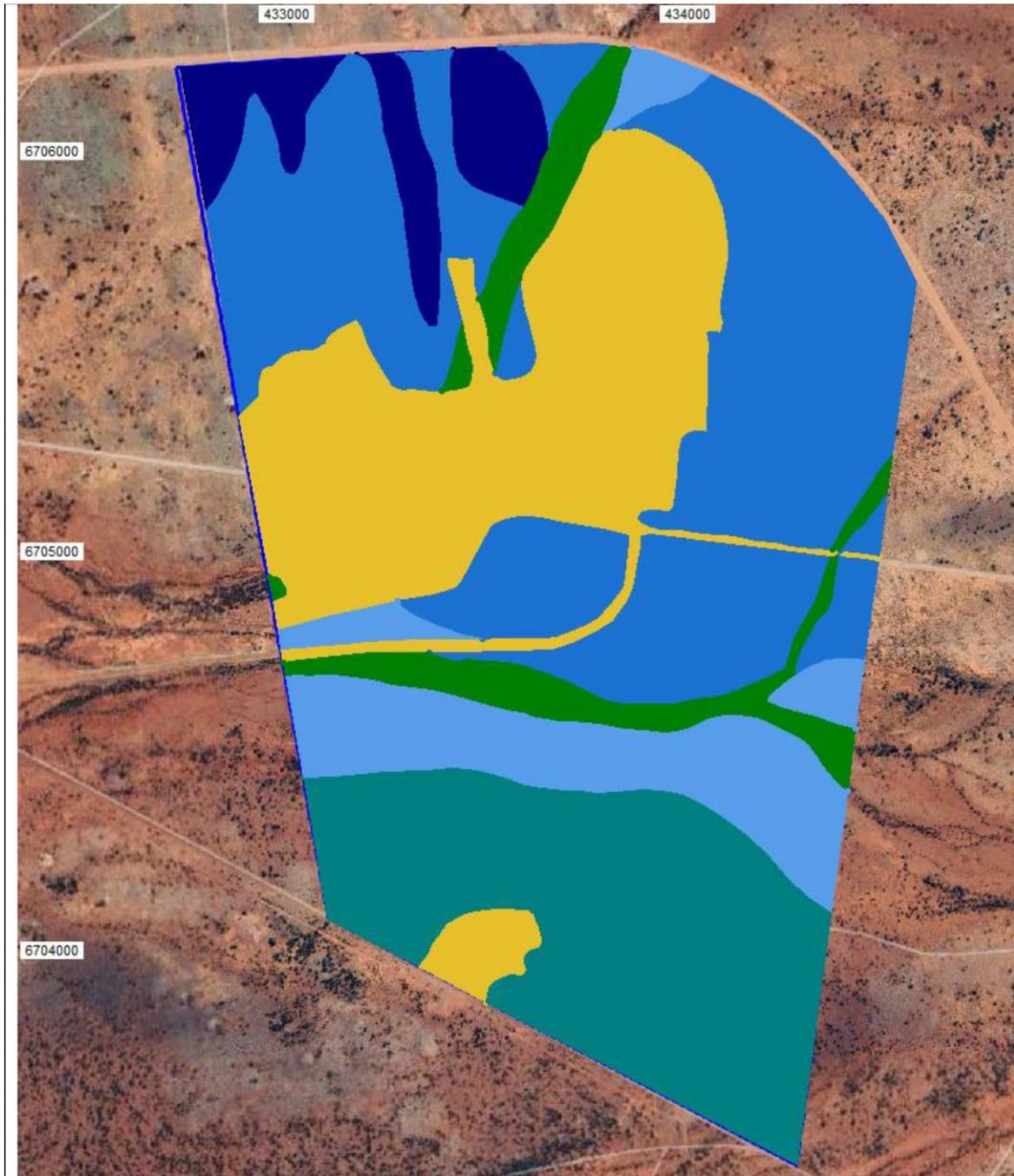
Table 1 Vegetation Representation (DBCA, 2018)

Vegetation Association	Scale	Pre-European Extent (ha)	Current Extent	%Remaining	% Remaining in DBCA Reserve
389	Statewide	642,356.85	640,468.79	99.71	3.58
	IBRA Bioregion Murchison	493,977.54	492,089.49	99.62	4.65
	IBRA Sub-region Eastern Murchison	493,977.54	492,089.49	99.62	4.65
	Local Government Authority Shire of Menzies	437,380.58	437,239.72	99.97	1.52
400	Statewide	190,823.50	189,665.42	99.39	unknown
	IBRA Bioregion Murchison	190,823.50	189,665.42	99.39	unknown
	IBRA Sub-region Eastern Murchison	190,823.50	189,665.42	99.39	unknown
	Local Government Authority Shire of Menzies	111,745.37	110,922.58	99.26	unknown

4.2 Vegetation Communities

AHA (2023) mapped five vegetation communities in the proposed clearing permit area (Figure 4-2). Vegetation communities were described as:

- **Calcyphytic pearl bluebush shrubland (CPBS)** - Sparse degraded chenopod shrubland dominated by *Maireana sedifolia* with isolated taller shrubs *Acacia burkittii* and *Senna artemisioides* subsp. *filifolia*.
- **Plain acacia shrubland (PACS)** - Mostly very sparse acacia shrublands commonly *Acacia tetragonophylla* and variously *Acacia incurvaneura*, *A. aptaneura*, *A. ramulosa* and *A. quadrimarginea* over very sparse lower shrubs including *Eremophila* spp., *Teucrium teucriflorum* and *Ptilotus obovatus*.
- **Plain mixed halophyte shrubland (PXHS)** - Very sparse to sparse, degraded chenopod shrublands dominated by *Maireana sedifolia* and *M. pyramidata* shrubland with very sparse overstorey of *Acacia incurvaneura*, *A. aptaneura* and *Casuarina pauper* with isolated *Pittosporum angustifolium*.
- **Hardpan plain acacia chenopod shrubland (HCAS)** - Very sparse degraded chenopod shrublands dominated by *Maireana pyramidata* with a very sparse or isolated overstorey of *Acacia tetragonophylla*, *A. ceasaneura*, *A. burkittii* and *Hakea preissii*.
- **Drainage tract acacia shrubland with chenopod understorey (DACs)** - Sparse to mid-dense acacia shrubland along drainage banks dominated by *Acacia burkittii* and *A. tetragonophylla* with taller *A. incurvaneura* and *Pittosporum angustifolium*. Sparse to mid-dense chenopod shrublands occur on islands and floodways dominated by *Maireana pyramidata* with *Atriplex bunburyana* and *Ptilotus obovatas*.



	2a: Low rises on volcanics	Calcyphytic pearl bluebush shrublands
	4c: Plains	Calcyphytic pearl bluebush shrublands Plain mixed halophyte low shrublands
	5a: Flood plains	Hardpan plain acacia chenopod shrubland
	3a: Granitic plains	Plain acacia shrubland
	6a: Drainage tracts	Drainage tract acacia shrubland
	MD: Mining disturbance	

Figure 4-2: Vegetation Communities (AHA, 2023)

4.3 Vegetation Condition

The proposed clearing permit area is within the Edjudina Pastoral Lease (N049971) and all areas have been heavily grazed and there is extensive mining infrastructure.

Vegetation structure and composition has been significantly altered throughout the entire survey area and scalding is widespread (Figure 4-3). Alluvial flood plains, associated with drainage tracts, supported vegetation attractive to livestock and are the most degraded (Table 2).

Table 2 Vegetation Condition (AHA, 2023)

Vegetation Condition	Area (ha)	%
Very Good	33.0	9
Good	236.2	64.3
Degraded	11.8	3.2
Completely Degraded	86.6	23.6
Not mapped	13.4	N/A

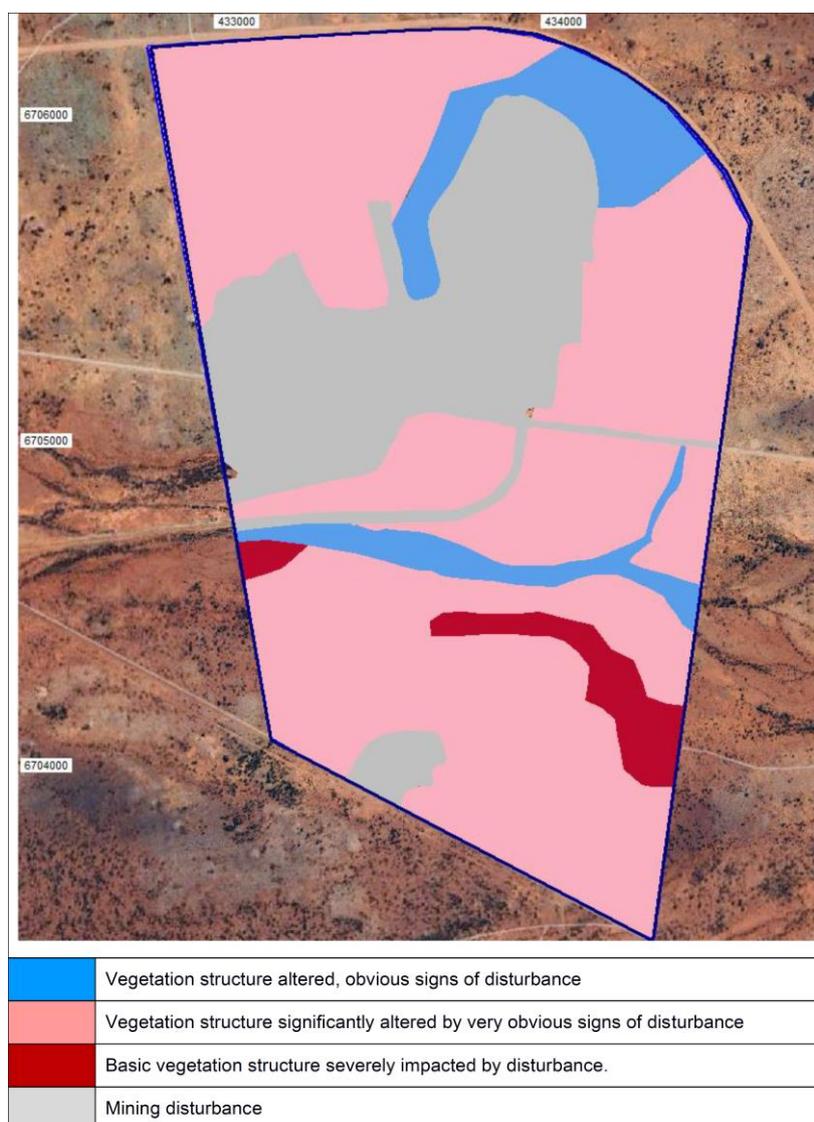


Figure 4-3: Vegetation Condition (AHA, 2023)

5 ASSESSMENT AGAINST THE TEN CLEARING PRINCIPLES

Proposed clearing has been assessed against the native vegetation clearing principles. The assessment identified that native vegetation clearing is unlikely to be at variance with nine of the 10 clearing principles.

Proposed clearing may be at variance with clearing principle f: *No permanent wetlands or watercourses occur within the clearing permit area*. One minor ephemeral drainage intersects the clearing permit area. All vegetation within the clearing permit area, including vegetation associated with the watercourses is well represented in the region.

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

Comments	Outcome
Assessment	<p>The clearing permit area is located within the Eastern Murchison (MUR1) subregion of the Murchison Interim Biogeographic Regionalisation of Australia (IBRA) bioregion. The Eastern Murchison subregion was described by CALM (2002) as vegetation dominated by Mulga woodlands often rich in ephemerals; hummock grasslands, saltbush shrublands and <i>Halosarcia</i> shrublands.</p> <p>Five vegetation communities were recorded in the clearing permit area:</p> <ul style="list-style-type: none"> • Calcyphytic pearl bluebush shrubland (CPBS) • Plain acacia shrubland (PACS) • Plain mixed halophyte shrubland (PXHS) • Hardpan plain acacia chenopod shrubland (HCAS) • Drainage tract acacia shrubland with chenopod understorey (DACS) <p>Vegetation within the clearing permit area was mapped in Completely Degraded to Very Good condition (AHA, 2023).</p> <p>No TECs, PECs or otherwise significant vegetation occur within in the clearing permit area.</p> <p>The clearing permit area does not contain any significant flora or fauna species, and fauna habitats are common and widespread in the region.</p> <p>The proposed clearing will require clearing of native vegetation that comprises a high level of biodiversity, and therefore is not at variance with this principle.</p>
Methods	<p>DBCA shapefiles</p> <p>Botanica (2010)</p> <p>AHA (2023)</p>

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

Comments	Outcome
Assessment	<p>Five fauna habitat types have been mapped within the clearing permit area (AHA, 2023):</p> <ul style="list-style-type: none"> • Low rises on volcanics with chenopod shrublands • Granitic plain supporting acacia shrublands • Plains supporting chenopod shrublands • Floodplain supporting chenopod shrublands • Drainage tracts with acacia shrublands and chenopod understory <p>Fauna habitats mapped in the area are common and widespread in the region.</p> <p>No Priority or Threatened fauna species were recorded during the fauna survey (AHA, 2023).</p> <p>The proposed clearing will not require clearing of native vegetation that comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia. The proposed clearing is therefore not at variance with this principle.</p>
Methods	<p>DBCA shapefiles</p> <p>Botanica (2010)</p> <p>AHA (2023)</p>

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

Comments	Outcome
Assessment	<p>No significant flora species occur within clearing permit area (AHA, 2023).</p> <p>Vegetation communities and land systems within the clearing permit area are common and widespread in the region.</p> <p>The proposed clearing is therefore not at variance with this principle.</p>
Methods	<p>DBCA shapefiles</p> <p>Botanica (2010)</p> <p>AHA (2023)</p>

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

Comments	Outcome
Assessment	<p>No TECs listed under State or Federal legislation occur within clearing permit area. The nearest Threatened or Priority Ecological Community is mapped approximately 50 km north of the clearing permit area.</p> <p>The proposed clearing is therefore not at variance with this principle.</p>
Methods	<p>DBCA shapefiles</p> <p>Botanica (2010)</p> <p>AHA (2023)</p>

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

Comments	Outcome
Assessment	<p>Two pre-European vegetation associations have been mapped within the proposed clearing permit area: 389 – succulent steppe with open low woodland, mulga over saltbush; and 400 succulent steppe with open low woodland, mulga over bluebush</p> <p>National objectives and targets for biodiversity conservation in Australia have a target to prevent clearance of ecological communities with an extent 30% of that present pre-1750, below which species loss appears to accelerate exponentially at ecosystem level (EPA, 2000).</p> <p>The percentages remaining statewide for vegetation association 389 and 400 are 99.71% and 99.39%, respectively. The proposed clearing will not reduce the extent of Vegetation Association 389 or 400 below this threshold.</p> <p>Although a low or unknown percentage of the vegetation types within the Murchison bioregion are protected within conservation reserves, the bioregion remains largely uncleared.</p> <p>The proposed clearing is unlikely to impact on the conservation status for these vegetation associations within the Murchison bioregion, and the clearing permit area does not represent a significant remnant of vegetation in an area that has been extensively cleared.</p> <p>The proposed clearing is therefore not at variance with this principle.</p>
Methods	<p>DBCA shapefiles</p> <p>DBCA (2019)</p> <p>Botanica (2010)</p> <p>AHA (2023)</p>

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

Comments	Outcome
Assessment	<p>No permanent wetlands or watercourses occur within the clearing permit area. One minor ephemeral drainage occurs within the clearing permit area. Vegetation associated with this drainage is common in the region.</p> <p>Clearing of vegetation associated with ephemeral watercourses will be avoided as far as practicable, but some clearing of this vegetation may be unavoidable.</p> <p>The proposed clearing may be at variance with this principle.</p>
Methods	<p>Botanica (2010)</p> <p>AHA (2023)</p>

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

Comments	Outcome
Assessment	<p>The clearing permit area overlies a pastoral lease and has been grazed over many years.</p> <p>Soils within the clearing permit area are characterized by the Gundockerta land system, which can be prone to soil erosion, particularly when soil surface are disturbed. Pringle <i>et al.</i> (1994) noted where not protected by stony mantle, saline plains and adjacent lower alluvial tracts are susceptible to water erosion, particularly in areas where perennial shrub cover is substantially reduced and / or the soil surface is disturbed.</p> <p>There has been no evidence of historic vegetation clearing exacerbating erosion or land degradation. It is possible this is due to the soils being stabilised by dust suppression and deposition of waste rock.</p> <p>The proposed clearing is therefore not likely to be at variance with this principle.</p>
Methods	<p>DBCA shapefiles</p> <p>DPIRD Shapefiles</p> <p>Botanica (2010)</p> <p>AHA (2023)</p>

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

Comments	Outcome
Assessment	<p>The closest conservation area is Goongarrie National Park, about 55 km west of the clearing permit area.</p> <p>The proposed clearing is therefore not at variance with this principle.</p>
Methods	<p>DBCA shapefiles</p> <p>Botanica (2010)</p> <p>AHA (2023)</p>

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

Comments	Outcome
Assessment	<p>This landscape drains internally, principally via sheet flow into minor, ephemeral drainage tracts that flow through the site and discharge to Lake Rebecca about 14 km southwest of the clearing permit area.</p> <p>Removal of vegetation along drainage tracts is not expected to result in deterioration of surface water or groundwater quality on the basis that modification of ephemeral watercourses will be managed to minimize erosion and sedimentation while maintaining water flows. A surface water diversion bund will be constructed to minimise disruptions to surface water drainage.</p> <p>The climate is arid to semi-arid with 230 mm of annual rainfall and annual evaporation rates are about 2800 mm. Recharge to groundwater is limited to years of extreme rainfall.</p> <p>The proposed clearing is therefore not likely to be at variance with this principle.</p>
Methods	<p>BOM (2024)</p> <p>Botanica (2010)</p> <p>AHA (2023)</p>

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

Comments	Outcome
Assessment	<p>The climate is arid to semi-arid with about 230 mm of annual rainfall. Rain falls on an average of 43 days a year.</p> <p>Most rainfall events will cause little runoff, however extreme rainfall events such as those recorded in summers of 1984 and 1967 will result in significant runoff.</p> <p>Drainage is predominantly sheetflow, with discharge into Lake Rebecca, a large playa lake of 268 km² with a catchment of 2,488 km² (Aquaterra 2007).</p> <p>The estimated 100 year ARI sheet flow of the watercourse is about 6m³/s (the 10 year ARI flow therefore may be in the order of 2m³/s) (Aquaterra, 2009). This has been managed adequately with a surface water diversion since the 2010s. Surface water management will continue in this manner during clearing and expansion of Enterprise.</p> <p>Clearing in this proposal will have negligible effect on the volume of discharge to Lake Rebecca.</p> <p>The proposed clearing is therefore not likely to be at variance with this principle.</p>
Methods	<p>DBCA shapefiles</p> <p>DPIRD Shapefiles</p> <p>Aquaterra 2009</p>

6 REFERENCES

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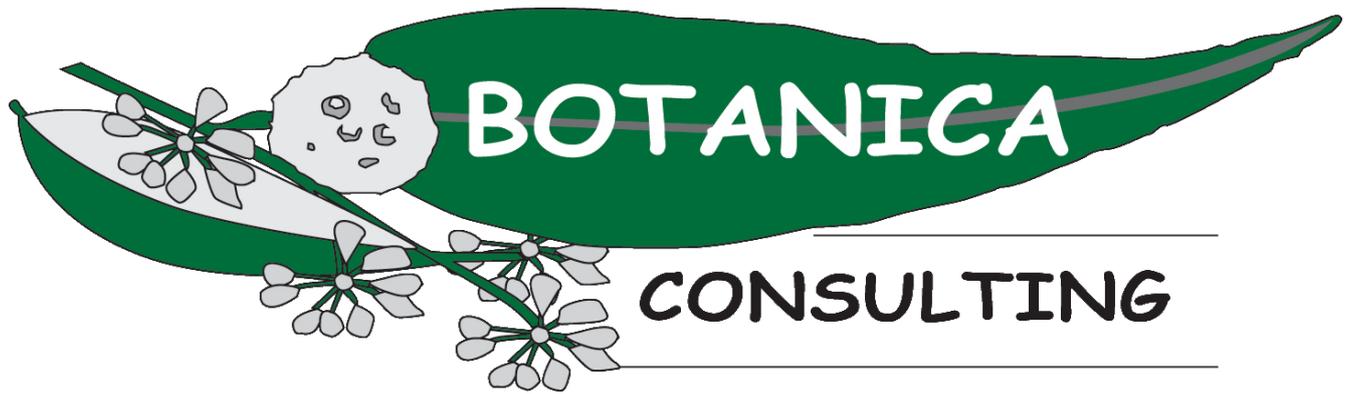
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7 APPENDICES

Appendix A: Vegetation and flora survey (Botanica, 2010)



Level 1 Flora and Vegetation Survey

(Tenements: M31/0003, M31/0004, M31/0005, M31/0006, M31/0030, M31/0059,
M31/0076, M31/0190, M31/0381, E31/0621, L31/0011)

Prepared For Saracen Mineral Holdings Pty Ltd



**July 2010
Final Report**

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Quality Assurance

An internal quality review process has been implemented to each project task undertaken by BC. Each document and its contents is carefully reviewed by core members of the Consultancy team and signed off at Director Level prior to issue to the client. Draft documents are submitted to the client for comment and acceptance prior to final production.

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Executive summary

Botanica Consulting (BC) was commissioned by Saracen Mineral Holdings (SAR) to undertake a Level 1 flora and vegetation survey of four separate areas covering a total of 586 hectares (ha); The Million Dollar area (373 ha), Enterprise Haul Road (20 ha), Margaret area (67 ha) and Tonbridge survey area (126 ha).

The survey area is located approximately 130 km north east of Kalgoorlie near the Yarri Road and Edjudina Road intersection. The survey was conducted on the 12th and 13th of July 2010 in accordance with the Environmental Protection Authority's (EPA) Guidance for the Assessment of Environmental Factors No. 51 (EPA, 2004).

Five vegetation groups were identified within the entire survey area: Creekline Vegetation, *Maireana pyramidata* Chenopod Shrubland, *Maireana sedifolia* Chenopod Shrubland, Mulga Woodland and *Casuarina pauper* Woodland. These vegetation groups comprised a total of 23 Families, 35 Genera and 51 Species (including subspecies and variants).

No Declared Rare Flora (DRF) or Priority Flora, pursuant to Subsection 2 of Section 23F of the Wildlife Conservation Act (1950) and listed by the Department of Environment and Conservation (DEC) (Atkins, 2010) were recorded by BC in any of the survey area vegetation groups.

The results of the combined search of the Department of Environment and Conservation's (DEC) Declared Rare and Priority Flora databases (DEC, 2010) revealed that no DRF species and one Priority species occurs in the search area (Appendix 4).

Four weed species, *Carthamus lanatus* (Saffron thistle) (P3), *Citrullus lanatus*, *Salvia verbenaca* and *Lysimachia arvensis* were recorded during the survey. One of the four species, *Carthamus lanatus* (P3) (Saffron thistle), is listed as Declared by the Department of Agriculture and Food Western Australia (DAFWA, 2010) (Appendix 5).

According to the Protected Matters Search Tool (DEWHA, 2010) the survey area has no regional environmental significance as defined by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). No Threatened Ecological Communities (TEC's) or Priority Ecological Communities (PEC's) listed under the *EPBC Act 1999* are known to occur in the survey area (DEWHA, 2010; DEC, 2010).

All vegetation groups within the survey area were classed as being in a "good" health condition (Keighery, 1994).

1.2 Previous relevant flora surveys

- **Supporting information for clearing permit applications associated with re-opening of the Porphyry mine site, Saracen 2007.**

Flora and vegetation surveys with the Porphyry Mine site area were conducted in 2006-2007 to provide supporting notes for clearing applications of three proposed developments;

1. Dewatering pipeline to Lake Rebecca (20ha).
2. Haul route south to existing Safari Bore haul road (50ha).
3. Pit expansion and associated infrastructure (83ha).

Dewatering pipeline to Lake Rebecca

A flora and vegetation survey of the proposed route of the dewatering pipeline was conducted on February 19 and March 28, 2007. No rare or priority flora species were found and there are no threatened ecological communities within the survey area. The area comprised of three land systems;

- Gunodockerta (Gun) characterised by extensive gently undulating plains on weathered greenstones with stony mantles and lower alluvial tracts supporting bluebush shrublands;
- Rainbow (Rai) characterised by cemented quaternary alluvium (hardpan) plains supporting mulga shrublands; and
- Carnegie (Cag) characterised by Quaternary sediments associated with salt lakes with fringing saline flats and dunes.

The pipeline survey area is located directly south of the Million Dollar survey area.

Haul route south to existing Safari Bore haul road

A flora and vegetation survey of the proposed haul road route was conducted on November 22-23, 2006 and March 28, 2007. No rare or priority flora species were found and there are no threatened ecological communities within the survey area. The proposed haul road consisted of seven land systems;

- Gunodockerta (Gun) is characterised by extensive gently undulating plains on weathered greenstones with stony mantles and lower alluvial tracts supporting bluebush shrublands;
- Rainbow (Rai) is characterised by cemented quaternary alluvium (hardpan) plains supporting mulga shrublands;
- Nubev (Nub) is characterised by gently undulating stony plains, minor low rises and drainage floors supporting mulga and halophytic shrublands;
- Leonora (Leo) is characterised by low greenstone hills and stony plains supporting mixed stony chenopod shrublands;
- Gransal (Grs) is characterised by stony plains and low rises on granite supporting mainly halophytic shrublands;

- Carnegie (Cag) is characterised by Quaternary sediments associated with salt lakes with fringing saline flats and dunes; and
- Desdemona (Des) is characterized by extensive Quaternary plains with deep sandy or loamy soils supporting mulga, spinifex and wanderrie grasses.

The proposed haul road survey area is located approximately 2.5km west of the current Million Dollar survey area.

Pit expansion and associated infrastructure

A flora and vegetation survey of the proposed site of pit extension/infrastructure development was conducted on August 24, 2006. No rare or priority species were found and there were no threatened ecological communities within the survey area. Three land systems were identified;

- Degraded sparse open chenopod shrubland with scattered *Acacia* species;
- Degraded chenopod shrubland with occasional *Eremophila longifolia*; and
- Degraded mulga shrubland over mixed halophytes.

The proposed pit expansion survey area is located directly north (200m) of the Enterprise Haul road survey area.

- **Environmental Assessment; Proposed Wallbrook Mine sites & surrounds, Alexander Holms & Associates, 2009.**

This report included environmental assessments of a 3.5km by 10 km envelope surrounding the Wallbrook area within Edjudina pastoral lease in the North Eastern Goldfields and clearing for Crusader, Eleven Bells and Redbrook mines, which are within the Wallbrook survey area.

Eleven land system units were identified within the survey area:

- Low hills on basalt;
- Low hills and rises on granitic rocks;
- Low rises and gently sloping plains on volcanic rocks;
- Low gravelly rises, minor breakaways and gently sloping plains;
- Stony weakly saline plains;
- Gravelly plains;
- Plains on granitic rocks;
- Hardpan plains;
- Alluvial plains;
- Drainage lines; and
- Groves and drainage foci.

Land units were mostly associated with bluebush shrublands and sandy granitic shrublands (SGRS). Vegetation was in good (score 2) to fair (score 3) condition. No rare or priority species were found among the one hundred and thirty five flora species identified from field surveys. There are no identified threatened ecological communities (TECs) in the biogeographic subregion (MUR1) covering the survey area.

The proposed Wallbrook Mine sites survey area is located approximately 3km south-east of the current survey area.

2 Regional Biophysical Environment

2.1 Topography & Soils

The survey area is located within the Murchison region (IBRA, 2010). This region is further divided into the East Murchison subregion and the Austin Botanical District (CALM, 2001; Beard, 1990). The East Murchison subregion topography is undulating with occasional ranges of low hills and extensive areas of elevated red desert sandplains (CALM, 2001). The area is characterised as having internal drainage with soils that are typically shallow earthy loam overlaying red-brown hardpan, shallow stony loams on hills and red sand on sand plains (Beard, 1990).

2.2 Climate

The climate of the Murchison region is characterised as arid with mainly winter rainfall and an annual precipitation of 200mm (Beard, 1990). Figure 2 shows the monthly rainfall for 2008, 2009 and 2010 compared against the mean rainfall data (1900 – 2010) for the Edjudina Weather Station, located 5 km west of the SAR survey areas.

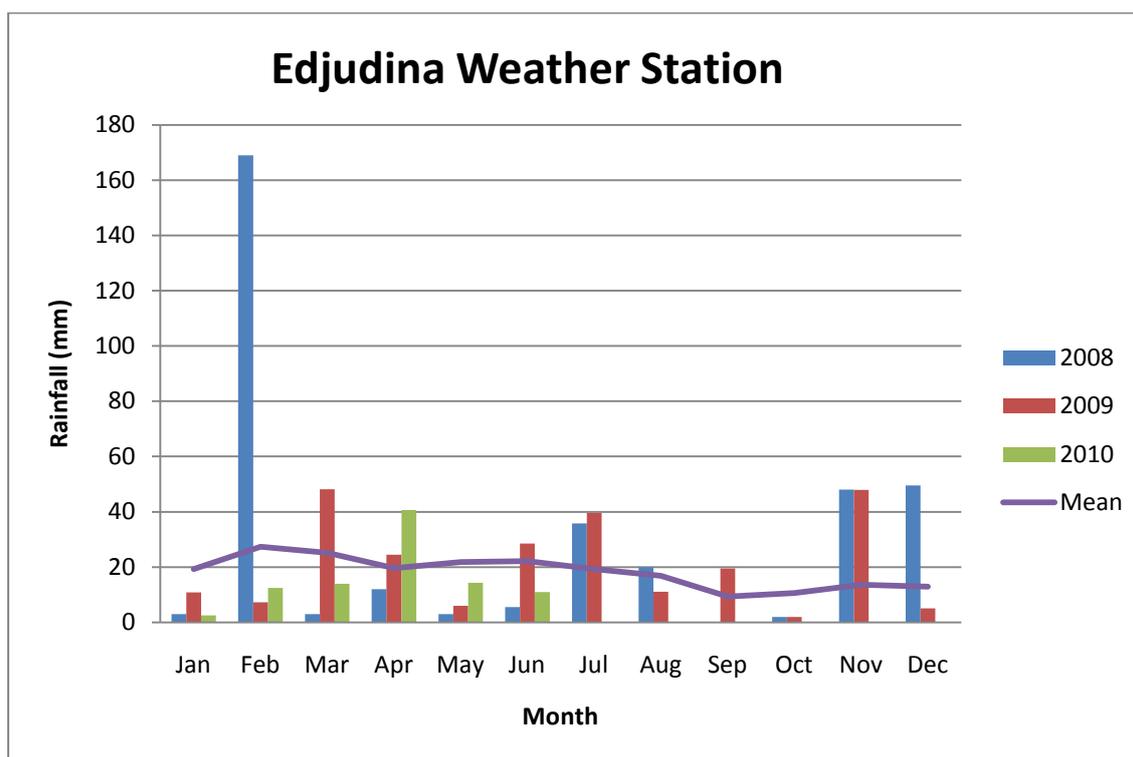


Figure 2: 2008-2010 monthly rainfall compared against mean rainfall (1900 – 2010) for the Edjudina weather station (#12027) (BOM, 2010).

2.3 Vegetation Groups

Beard (1990) locates the survey area within the Austin Botanical District of the Murchison Region. The vegetation of the Austin Botanical District is dominated by Mulga Woodlands (*Acacia aneura*) on plains often rich in ephemerals such as hummock grasslands, saltbush shrublands and Halosarcia shrublands (Beard, 1990). Beeston *et. al.*, (2002) place the survey areas within Pre-European Beard vegetation association 389 and 400 (Table 1).

**Table 1: Pre-European Beard Vegetation Association within the Saracen survey area
(Beeston, *et. al.*, 2002).**

Beard Vegetation Association	Current Extent (ha)	Pre-European extent (ha)	Remaining (%)	Description
389	646,554	646,554	100	Succulent steppe with open low woodland; mulga over saltbush.
400	192,391	192,391	100	Succulent steppe with open low woodland; mulga over bluebush.

2.4 Land Use

Grazing of native pastures accounts for the vast majority of land use in the East Murchison subregion (85.47%) with the remaining 11.34 % of land use categorised as Unoccupied Crown Land (UCL) and Crown reserves (CALM, 2001). Mining of nickel and gold in the region is considerable, however most mining leases still come under the pastoral lands acts. The majority of conservation estate in the subregion falls outside the IUCN I-IV categories at 1.4% of land use.

2.5 Survey Objectives

1. Prepare a vegetation map and species list for the survey areas.
2. Create a list of threatened plant species and ecological communities that have potential to occur within the survey area.
3. Review flora considered to be rare, threatened, or geographically restricted in surrounding areas, and target these species in the survey area.
4. Assess the status of introduced plant species within the survey area.
5. Assess the regional and local conservation status of plant species and ecological communities within the survey area.
6. Assess the potential impact of exploration and possible future mining activities on the flora of the area.

3 Survey Methodology

3.1 Desktop Assessment

Prior to the field survey, the results of the combined search of the DEC's Declared Rare and Priority Flora databases (DEC, 2010a), were obtained by BC. These significant flora species were examined on the Western Australian Herbarium's web page (WAHERB, 2010) prior to the survey to familiarise staff with their appearance. Locations of DRF and Priority Flora species revealed in the databases search were overlaid on aerial photography of the area. Vegetation descriptions of locations and available pictures of the Priority Flora were obtained from Florabase.

Priority Flora and their respective vegetation types were targeted in the survey area and all areas of occurrence were traversed on foot looking specifically for the threatened flora associated with that vegetation description.

Table 2 lists the definitions of Declared Rare and Priority ratings under the *Wildlife Conservation Act (1950)* as extracted from Florabase (WAHERB, 2010).

Table 2: Definitions of Rare and Priority Flora Species (WAHERB, 2010).

R: Declared Rare Flora – Extant Taxa Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
X: Declared Rare flora – Presumed Extinct Taxa Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
1: Priority One – Poorly known Taxa Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small populations size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc, or the plants are under threat, e.g. From disease, grazing by feral animals, etc. May include taxa with threatened populations in protected lands. Such taxa are under consideration for declaration as "rare flora", but are in urgent need of further survey.
2: Priority Two – Poorly Known Taxa Taxa which are known from one of a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as "rare flora", but are in urgent need of further survey.
3: Priority Three – Poorly known Taxa Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally <5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as "rare flora" but are in need of further survey.
4: Priority Four – Rare Taxa Taxa, which are considered to have been adequately surveyed, and which whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years

3.2 Sampling and Analysis Methods

The survey area was traversed by two people via four wheel drive and on foot where appropriate. Prior to the field work, aerial images were analysed in order to determine the separate vegetation groups. These different vegetation groups were then visited during the field survey to assess their validity. A handheld Global Positioning System (GPS) unit was used to obtain the co-ordinates of the boundaries between existing vegetation groups (Appendix 8).

During the inspection of each vegetation group the survey team observed and collected specimens from the entire extent of the vegetation group in order to create a species list. Photographs were taken within each vegetation group. Unknown specimens collected during the survey were identified with the aid of samples housed at the BC Herbarium and the Western Australian Herbarium.

3.3 Personnel involved

Jim Williams- Environmental Consultant/Botanist (Diploma of Horticulture)

Monique Toubia- Environmental Consultant (MSc- Natural Resource Management)

3.4 Flora survey limitations and constraints

It is important to note that there are limitations involved with conducting flora surveys, despite the careful planning that is put into their design. Such limitations that can occur are listed in Table 3.

Table 3: Limitations and constraints associated with the flora and vegetation survey.

Variable	Impact on Survey outcomes
Access problems	Access was not a problem as the survey was conducted via 4WD and on foot.
Experience levels	The BC personnel that conducted the survey were regarded as suitably qualified and experienced. Coordinating Botanist: Jim Williams Field Staff: Jim Williams & Monique Toubia Data Interpretation: Jim Williams.
Timing of survey, weather & season	Fieldwork was completed outside of the EPA's recommended time period (i.e., Spring). In the two months preceding the survey, rainfall was below average for the Eududina weather station (BOM, 2010).
Completeness	In the opinion of BC the survey area was covered sufficiently. BC estimate that approximately 90% of the flora species in the survey area were recorded. This estimation takes into account the timing of the survey and the experience of the botanists undertaking the work. The vegetation groups for this study were based on visual descriptions of locations in the field. The distribution of these vegetation groups outside the study area is not known, however vegetation groups identified were categorized via comparison to vegetation distributions throughout WA given on Australian Natural Resources Atlas (ANRA, 2010).

4 Results

4.1 Summary

The entire survey area is made up of five vegetation groups. All have been classed as being in a “good” health condition (Keighery, 1994). This designation indicates that the vegetation structure has been affected by multiple disturbances, however still retains its basic structure and has the ability to regenerate. Keighery’s health ratings are found in Appendix 6.

No vegetation groups contained DRF or Priority Flora, pursuant to Subsection 2 of Section 23F of the Wildlife Conservation Act (1950) and listed by the DEC (Atkins, 2010).

Four weed species, *Carthamus lanatus* (Saffron thistle), *Citrullus lanatus*, *Salvia verbenaca* and *Lysimachia arvensis* were recorded during the survey. One of the three species, *Carthamus lanatus* (P3) (Saffron thistle), is listed as Declared by the Department of Agriculture and Food WA and was found in the Mulga Woodland vegetation group (DAFWA, 2010). A description of the declared status of this species is provided in Appendix 5.

4.2 Desktop Assessment

The results of the combined search of the DEC Declared Rare and Priority Flora databases (DEC, 2010) revealed that only one Priority Flora species occurs 5.5 km from the survey area (Appendix 4). Table 4 lists the species that have the potential to occur within the survey area including a species description (DEC, 2010).

Table 4: Priority Flora with the potential to occur within the survey area (DEC, 2010).

Species	Priority	Description (WAHERB, 2010)
<i>Thryptomene eremaea</i>	2	Erect open shrub, 0.5–1.5 m high. Fl. pink, white, Jul–Sep. Red or yellow sand. Sandplains.

4.3 Vegetation Groups

Five vegetation groups were identified within the survey area. These were:

- 1) Creekline Vegetation
- 2) *Maireana pyramidata* Chenopod Shrubland
- 3) *Maireana sedifolia* Chenopod Shrubland
- 4) Mulga Woodland
- 5) *Casuarina pauper* Woodland

These vegetation groups comprised a total of 23 Families, 35 Genera and 51 Species (including subspecies and variants) (Appendix 3).

The maps showing the vegetation groups present in the survey area is located in Appendix 2. Based on the Keighery health rating scale all five vegetation groups were classified as being in 'good' condition (Appendix 6).

5 Million Dollar area

The Million Dollar survey area covers 373 ha and is comprised of three vegetation groups;

- Creekline Vegetation;
- Mulga Woodland; and
- *Casuarina pauper* woodland.

Descriptions of each vegetation group identified within the Million Dollar area are provided below. All vegetation groups identified within the Million Dollar area are considered to be in good condition according to the Keighery Health rating scale (Appendix 6).

No Declared Rare Flora or Priority Flora, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were found within the Million Dollar area. One Declared Weed species (*Carthamus lanatus* (P3) (Saffron thistle) according to the Department of Agriculture and Food WA was identified within the Million Dollar Area (DAFWA, 2010). A full description of this Declared Weed species is provided in Appendix 5. Another non-declared weed species (according to DAFWA) was also identified within the Million Dollar survey area; *Salvia verbenaca*.

5.1 Creekline Vegetation

5.1.1 Flora

Flora recorded in the Creekline Vegetation group are represented by 8 Families, 10 Genera and 14 Species.

No DRF or Priority Flora, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were found in this vegetation group.

The weed species, *Lysimachia arvensis*, was found in this vegetation group, however it is not listed as a Declared Weed species according to the Department of Agriculture and Food WA (DAFWA, 2010).

5.1.2 Vegetation

This vegetation group had an upper storey of *Acacia burkittii*, *Santalum lanceolatum* and *Santalum spicatum*. The mid-storey included *Eremophila longifolia*, *Acacia tetragonophylla* and *Maireana pyramidata*. The lower-storey included *Sida calyxhymenia*, *Maireana triptera* and *Cheilanthes sieberi* subsp. *sieberi*. Many germinants of Asteraceae sp. were found within this vegetation group. Dominant species from the vegetation assemblage according to Muir (1977) are shown in Table 5.

Table 5: Vegetation assemblage for Creekline Vegetation within the Million Dollar survey area (Muir, 1977).

Life Form/ Height Class	Canopy Cover	Dominant species present
Shrubs > 2m	30-70%	<i>Acacia aneura</i>
Shrubs 0.5-1m	2-10%	<i>Maireana pyramidata</i>
Shrubs 0-0.5m	2-10%	<i>Ptilotus obovatus</i>

According to Australian Natural Resources Atlas (ANRA) this vegetation group is best represented by the Acacia shrubland vegetation group, which covers 8.5% of Western Australia (ANRA, 2010).

No broad scale clearing has occurred for agricultural purposes in this community within the survey area.



Figure 3: Image of creekline vegetation identified within the Million Dollar area.

5.2 Mulga Woodland

5.2.1 Flora

Flora recorded in this vegetation group are represented by 19 Families, 23 Genera and 33 Species.

No DRF species or Priority flora pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were recorded within this vegetation group.

One Declared weed species; *Carthamus lanatus* (P3) (Saffron thistle) as listed by the Department of Agriculture and Food WA (DAFWA) was identified within this vegetation group (DAFWA, 2010). A full description of this Declared Weed species is provided in Appendix 5. Another non-declared weed species was also identified within this vegetation group; *Salvia verbenaca*.

5.2.2 Vegetation

The upper-storey comprised of *Acacia ramulosa*, *Acacia aneura*, *Acacia tetragonophylla* and *Casuarina pauper*. The middle canopy included *Maireana sedifolia*, *Maireana pyramidata*, *Maireana triptera*, *Themeda triandra* and *Eremophila longifolia*. The lower-storey included *Scaevola spinescens*, *Eremophila clarkei* and *Solanum ferocissimum*. Dominant species from the vegetation assemblage according to Muir (1977) is shown in Table 8.

Table 6: Vegetation assemblage for Mulga Woodland within the Million Dollar survey area (Muir, 1977).

Life Form/ Height Class	Canopy Cover	Dominant species present
Shrubs >2m	10-30%	<i>Acacia aneura</i> <i>Acacia ramulosa</i>
Shrubs 0.5-1m	2-10%	<i>Eremophila forrestii</i> <i>Scaevola spinescens</i>
Shrubs 0-0.5m	2-10%	<i>Ptilotus obovatus</i> <i>Maireana triptera</i>

No broad scale clearing for agricultural purposes has occurred in this vegetation group within the survey area.

According to the ANRA this vegetation group is best represented by the Acacia Open Woodlands vegetation group, which covers 0.1% of Western Australia (ANRA, 2010).



Figure 4: Image of Mulga Woodland in the Million Dollar survey area.



Figure 5: Image of Mulga Woodland in the Million Dollar survey area with emerging germinant Asteraceae species

5.3 *Casuarina pauper* Woodland

5.3.1 Flora

Flora recorded in this vegetation group are represented by 9 Families, 9 Genera and 10 Species.

No DRF species or Priority flora pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were recorded within this vegetation group.

No weed species were found in this vegetation group.

5.3.2 Vegetation

The upper-storey comprised of *Acacia aneura* and *Casuarina pauper*. The middle canopy included *Dodonaea lobulata*, *Exocarpos aphyllus*, *Maireana sedifolia*, *Maireana pyramidata*, *Hakea preissii*, and *Eremophila forrestii*. The lower-storey included *Ptilotus obovatus* and Poaceae sp. Dominant species from the vegetation assemblage according to Muir (1977) is shown in Table 9.

Table 7: Vegetation assemblage for *Casuarina pauper* Woodland within the Million Dollar survey area (Muir, 1977).

Life Form/Height Class	Canopy Cover	Dominant species present
Tree <5 m	10-30%	<i>Casuarina pauper</i>
Shrubs 0.5-1m	2-10%	<i>Dodonaea lobulata</i>
Shrubs 0-0.5m	2-10%	<i>Ptilotus obovatus</i> <i>Scaevola cuneata</i>

No broad scale clearing for agricultural purposes has occurred in this vegetation group within the survey area.

According to the ANRA this vegetation group is best represented by the *Casuarina* Woodlands vegetation group, which covers 0.1% of Western Australia (ANRA, 2010).



Figure 6: Image of *Casuarina pauper* woodland in the Million Dollar survey area.

6 Enterprise Haul Road

The Enterprise Haul Road covered an area of 20 ha and comprised of three vegetation groups;

- Creekline vegetation;
- *Maireana pyramidata* Chenopod Shrubland; and
- *Maireana sedifolia* Chenopod Shrubland.

Descriptions of each vegetation group identified within the Enterprise Haul Road are provided below. All vegetation groups identified within the Enterprise Haul Road area are considered to be in good condition according to the Keighery Health rating scale (Appendix 6).

No DRF or Priority Flora, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were identified within the Enterprise Haul Road survey area. No Declared weed species according to the Department of Agriculture and Food WA were identified within the Enterprise Haul Road survey area (DAFWA, 2010).

6.1 **Creekline Vegetation**

6.1.1 **Flora**

Flora recorded in the Creekline Vegetation group are represented by 8 Families, 10 Genera and 14 Species.

No DRF or Priority Flora, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were found in this vegetation group.

The weed species, *Lysimachia arvensis*, was found in this vegetation group however it is not listed as a Declared Weed species according to the Department of Agriculture and Food WA (DAFWA, 2010).

6.1.2 **Vegetation**

This vegetation group had an upper storey of *Acacia burkittii*, *Santalum lanceolatum* and *Santalum spicatum*. The mid-storey included *Eremophila longifolia*, *Acacia tetragonophylla* and *Maireana pyramidata*. The lower-storey included *Sida calyxhymenia*, *Maireana triptera* and *Cheilanthes sieberi* subsp. *sieberi*. Dominant species from the vegetation assemblage according to Muir (1977) are shown in Table 8.

Table 8: Vegetation assemblage for Creekline Vegetation within the Enterprise Haul Road survey area (Muir, 1977).

Life Form/ Height Class	Canopy Cover	Dominant species present
Shrubs > 2m	30-70%	<i>Acacia burkittii</i>
Shrubs 0.5-1m	2-10%	<i>Maireana pyramidata</i>
Shrubs 0-0.5m	2-10%	<i>Ptilotus obovatus</i>

According to Australian Natural Resources Atlas (ANRA) this vegetation group is best represented by the Acacia shrubland vegetation group, which covers 8.5% of Western Australia (ANRA, 2010).

No broad scale clearing has occurred for agricultural purposes in this community within the survey area.



Figure 7: Image of creekline vegetation identified within the Enterprise Haul Road area.

6.2 *Maireana pyramidata* Chenopod Shrubland

6.2.1 Flora

Flora recorded in this vegetation group are represented by 14 Families, 18 Genera and 26 Species.

No DRF species or Priority flora pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were recorded within this vegetation group.

The weed species, *Citrullus lanatus* was found in this vegetation group, however it is not listed as a Declared weed (DAFWA, 2010).

6.2.2 Vegetation

The upper-storey comprised of *Eucalyptus torquata*, *Santalum lanceolatum*, *Acacia aneura*, *Acacia burkittii*, *Acacia tetragonophylla* and *Hakea preissii*. The middle canopy included *Maireana sedifolia*, *Maireana pyramidata*, *Pittosporum angustifolium*, *Themeda triandra* and *Eremophila longifolia*. The lower-storey included *Scaevola spinescens*, *Eremophila clarkei* and *Solanum ferocissimum*. Dominant species from the vegetation assemblage according to Muir (1977) is shown in Table 9.

Table 9: Vegetation assemblage for *Maireana pyramidata* Chenopod Shrubland within the Enterprise Haul Road survey area (Muir, 1977).

Life Form/ Height Class	Canopy Cover	Dominant species present
Tree < 5 m	2-10%	<i>Acacia aneura</i>
Shrubs 1.5-2m	10-30%	<i>Maireana pyramidata</i>
Shrubs 0.5-1	2-10%	<i>Ptilotus obovatus</i> <i>Scaevola cuneata</i>

According to the ANRA this vegetation group is best represented by the Chenopod shrub vegetation group, which covers 7.6% of Western Australia (ANRA, 2010).

No broad scale clearing has occurred for agricultural purposes in this community within the survey area.



Figure 8: Image of *Maireana pyramidata* Chenopod Shrubland within the Enterprise Haul Road survey area.

6.3 *Maireana sedifolia* Chenopod Shrubland

6.3.1 Flora

Flora recorded in this vegetation group are represented by 14 Families, 18 Genera and 26 Species.

No DRF species or Priority flora pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were recorded within this vegetation group.

The weed species *Citrullus lanatus* was found in this vegetation group, however it is not listed as a Declared weed (DAFWA, 2010).

6.3.2 Vegetation

The upper-storey comprised of *Santalum lanceolatum*, *Acacia aneura*, *Acacia burkittii*, *Acacia tetragonophylla* and *Hakea preissii*. The middle canopy included *Maireana sedifolia*, *Maireana pyramidata*, *Pittosporum angustifolium*, *Themeda triandra* and *Eremophila longifolia*. The lower-storey included *Scaevola spinescens*, *Eremophila clarkei* and *Solanum ferocissimum*. Dominant species from the vegetation assemblage according to Muir (1977) is shown in Table 10.

Table 10: Vegetation assemblage for *Maireana sedifolia* Chenopod Shrubland within the Enterprise Haul Road survey area (Muir, 1977).

Life Form/ Height Class	Canopy Cover	Dominant species present
Shrubs 1.5-2m	2-10%	<i>Acacia aneura</i>
Shrubs 0.5-1m	10-30%	<i>Maireana sedifolia</i>
Shrubs 0-0.5m	10-30%	<i>Ptilotus obovatus</i> <i>Scaevola cuneata</i>

No broad scale clearing for agricultural purposes has occurred in this vegetation group within the survey area.

According to the ANRA this vegetation group is best represented by the Chenopod shrub vegetation group, which covers 7.6% of Western Australia (ANRA, 2010).



Figure 9: Image of *Maireana sedifolia* Chenopod Shrubland within the Enterprise Haul Road survey area.

7 Margaret Area

The Margaret Area covered an area of 67 ha and comprised of three vegetation groups;

- Creekline vegetation;
- *Maireana pyramidata* Chenopod Shrubland; and
- *Maireana sedifolia* Chenopod Shrubland.

Descriptions of each vegetation group identified within the Margaret Area are provided below. All vegetation groups identified within the Margaret area are considered to be in good condition according to the Keighery Health rating scale (Appendix 6).

No DRF or Priority Flora, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were identified within the Margaret survey area. No Declared weed species according to the Department of Agriculture and Food WA were identified within the Margaret survey area (DAFWA, 2010).

7.1 **Creekline Vegetation**

7.1.1 **Flora**

Flora recorded in the Creekline Vegetation group are represented by 8 Families, 10 Genera and 14 Species.

No DRF or Priority Flora, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were found in this vegetation group.

The weed species *Lysimachia arvensis* was found in this vegetation group, however it is not listed as a Declared weed species (DAFWA, 2010).

7.1.2 **Vegetation**

This vegetation group had an upper storey of *Acacia burkittii*, *Santalum lanceolatum* and *Santalum spicatum*. The mid-storey included *Eremophila longifolia*, *Acacia tetragonophylla* and *Maireana pyramidata*. The lower-storey included *Sida calyxhymenia*, *Maireana triptera* and *Cheilanthes sieberi* subsp. *sieberi*. Dominant species from the vegetation assemblage according to Muir (1977) are shown in Table 11.

Table 11: Vegetation assemblage for Creekline Vegetation within the Margaret survey area (Muir, 1977).

Life Form/ Height Class	Canopy Cover	Dominant species present
Shrubs > 2m	30-70%	<i>Acacia aneura</i>
Shrubs 0.5-1m	2-10%	<i>Maireana pyramidata</i>
Shrubs 0-0.5m	2-10%	<i>Ptilotus obovatus</i>

According to Australian Natural Resources Atlas (ANRA) this vegetation group is best represented by the Acacia shrubland vegetation group, which covers 8.5% of Western Australia (ANRA, 2010).

No broad scale clearing has occurred for agricultural purposes in this community within the survey area.



Figure 10: Image of creekline vegetation identified within the Margaret Area.

7.2 *Maireana pyramidata* Chenopod Shrubland

7.2.1 Flora

Flora recorded in this vegetation group are represented by 14 Families, 18 Genera and 26 Species.

No DRF species or Priority flora pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were recorded within this vegetation group.

The weed species *Citrullus lanatus* was found in this vegetation group, however it is not listed as a Declared weed (DAFWA, 2010).

7.2.2 Vegetation

The upper-storey comprised of *Santalum lanceolatum*, *Acacia aneura*, *Acacia burkittii*, *Acacia tetragonophylla* and *Hakea preissii*. The middle canopy included *Maireana sedifolia*, *Maireana pyramidata*, *Pittosporum angustifolium*, *Themeda triandra* and *Eremophila longifolia*. The lower-storey included *Scaevola spinescens*, *Eremophila clarkei* and *Solanum ferocissimum*. Dominant species from the vegetation assemblage according to Muir (1977) is shown in Table 12.

Table 12: Vegetation assemblage for *Maireana pyramidata* Chenopod Shrubland within the Margaret survey area (Muir, 1977).

Life Form/ Height Class	Canopy Cover	Dominant species present
Shrubs > 2m	2-10%	<i>Acacia aneura</i>
Shrubs 1.5-2m	10-30%	<i>Maireana pyramidata</i>
Shrubs 0.5-1	2-10%	<i>Ptilotus obovatus</i> <i>Scaevola cuneata</i>

According to the ANRA this vegetation group is best represented by the Chenopod shrub vegetation group, which covers 7.6% of Western Australia (ANRA, 2010).

No broad scale clearing has occurred for agricultural purposes in this community within the survey area.



Figure 11: Image of *Maireana pyramidata* Chenopod Shrubland within the Margaret survey area.

7.3 *Maireana sedifolia* Chenopod Shrubland

7.3.1 Flora

Flora recorded in this vegetation group are represented by 14 Families, 18 Genera and 26 Species.

No DRF species or Priority flora pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were recorded within this vegetation group.

The weed species *Citrullus lanatus* was found in this vegetation group, however it is not listed as a Declared weed (DAFWA, 2010).

7.3.2 Vegetation

The upper-storey comprised *Santalum lanceolatum*, *Acacia aneura*, *Acacia burkittii*, *Acacia tetragonophylla* and *Hakea preissii*. The middle canopy included *Maireana sedifolia*, *Maireana pyramidata*, *Pittosporum angustifolium*, *Themeda triandra* and *Eremophila longifolia*. The lower-storey included *Scaevola spinescens*, *Eremophila clarkei* and *Solanum ferocissimum*. Dominant species from the vegetation assemblage according to Muir (1977) is shown in Table 13.

Table 13: Vegetation assemblage for *Maireana sedifolia* Chenopod Shrubland within the Margaret survey area (Muir, 1977).

Life Form/ Height Class	Canopy Cover	Dominant species present
Tree <5 m	2-10%	<i>Acacia aneura</i>
Shrubs 0.5-1m	30-70%	<i>Maireana sedifolia</i>
Shrubs 0-0.5m	10-30%	<i>Ptilotus obovatus</i> <i>Scaevola cuneata</i>

No broad scale clearing for agricultural purposes has occurred in this vegetation group within the survey area.

According to the ANRA this vegetation group is best represented by the Chenopod shrub vegetation group, which covers 7.6% of Western Australia (ANRA, 2010).



Figure 12: Image of *Maireana sedifolia* Chenopod Shrubland within the Margaret survey area.

8 Tonbridge survey area

The Tonbridge Area covered an area of 126 ha and comprised of four vegetation groups;

- Mulga Woodland;
- Creekline vegetation;
- *Maireana pyramidata* Chenopod Shrubland; and
- *Maireana sedifolia* Chenopod Shrubland.

Descriptions of each vegetation group identified within the Tonbridge Area are provided below. All vegetation groups identified within the Tonbridge area are considered to be in good condition according to the Keighery Health rating scale (Appendix 6).

No DRF or Priority Flora, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were identified within the Tonbridge survey area. One Declared weed species *Carthamus lanatus* (P3) (Saffron thistle) as listed by the Department of Agriculture and Food WA was identified within the Tonbridge survey area (DAFWA, 2010).

8.1 **Mulga Woodland**

8.1.1 **Flora**

Flora recorded in this vegetation group are represented by 19 Families, 23 Genera and 33 Species.

No DRF species or Priority flora pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were recorded within this vegetation group.

One Declared weed species; *Carthamus lanatus* (P3) (Saffron thistle) as listed by the Department of Agriculture and Food WA (DAFWA) was identified within this vegetation group (DAFWA, 2010). A full description of this Declared Weed species is provided in Appendix 5. Another non-declared weed species (according to DAFWA) was also identified within this vegetation group; *Salvia verbenaca*.

8.1.2 **Vegetation**

The upper-storey comprised of *Acacia ramulosa*, *Acacia aneura*, *Acacia tetragonophylla* and *Casuarina pauper*. The middle canopy included *Maireana sedifolia*, *Maireana pyramidata*, *Maireana triptera*, *Themeda triandra* and *Eremophila longifolia*. The lower-storey included *Scaevola spinescens*, *Eremophila clarkei* and *Solanum ferocissimum*. Dominant species from the vegetation assemblage according to Muir (1977) is shown in Table 14.

Table 14: Vegetation assemblage for Mulga Woodland within the Tonbridge survey area (Muir, 1977).

Life Form/ Height Class	Canopy Cover	Dominant species present
Tree < 5 m	10-30%	<i>Acacia aneura</i> <i>Acacia ramulosa</i>
Shrubs 0.5-1m	2-10%	<i>Eremophila forrestii</i> <i>Scaevola spinescens</i>
Shrubs 0-0.5m	2-10%	<i>Ptilotus obovatus</i> <i>Maireana triptera</i>

No broad scale clearing for agricultural purposes has occurred in this vegetation group within the survey area.

According to the ANRA this vegetation group is best represented by the Acacia Open Woodlands vegetation group, which covers 0.1% of Western Australia (ANRA, 2010).



Figure 13: Image of Mulga Woodland in the Tonbridge survey area.

8.2 Creekline Vegetation

8.2.1 Flora

Flora recorded in the Creekline Vegetation group are represented by 8 Families, 10 Genera and 14 Species.

No DRF or Priority Flora, pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were found in this vegetation group.

The weed species *Lysimachia arvensis* was found in this vegetation group; however it is not listed as a Declared weed species (DAFWA, 2010).

8.2.2 Vegetation

This vegetation group had an upper storey of *Acacia burkittii*, *Santalum lanceolatum* and *Santalum spicatum*. The mid-storey included *Eremophila longifolia*, *Acacia tetragonophylla* and *Maireana pyramidata*. The lower-storey included *Sida calyxhymenia*, *Maireana triptera* and *Cheilanthes sieberi* subsp. *sieberi*. Many germinants species of the Asteraceae family were recorded within this vegetation group. Dominant species from the vegetation assemblage according to Muir (1977) are shown in Table 15.

Table 15: Vegetation assemblage for Creekline Vegetation within the Tonbridge survey area (Muir, 1977).

Life Form/ Height Class	Canopy Cover	Dominant species present
Shrubs > 2m	30-70%	<i>Acacia burkittii</i>
Shrubs 0.5-1m	2-10%	<i>Maireana pyramidata</i>
Shrubs 0-0.5m	2-10%	<i>Ptilotus obovatus</i>

According to Australian Natural Resources Atlas (ANRA) this vegetation group is best represented by the Acacia shrubland vegetation group, which covers 8.5% of Western Australia (ANRA, 2010).

No broad scale clearing has occurred for agricultural purposes in this community within the survey area.



Figure 14: Image of creekline vegetation identified within the Tonbridge survey area.

8.3 *Maireana pyramidata* Chenopod Shrubland

8.3.1 Flora

Flora recorded in this vegetation group are represented by 14 Families, 18 Genera and 26 Species.

No DRF species or Priority flora pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were recorded within this vegetation group.

The weed species *Citrullus lanatus* was found in this vegetation group, however it is not listed as a Declared weed (DAFWA, 2010).

8.3.2 Vegetation

The upper-storey comprised of *Santalum lanceolatum*, *Acacia aneura*, *Acacia burkittii*, *Acacia tetragonophylla* and *Hakea preissii*. The middle canopy included *Maireana sedifolia*, *Maireana pyramidata*, *Pittosporum angustifolium*, *Themeda triandra* and *Eremophila longifolia*. The lower-storey included *Scaevola spinescens*, *Eremophila clarkei* and *Solanum ferocissimum*. Dominant species from the vegetation assemblage according to Muir (1977) is shown in Table 16.

Table 16: Vegetation assemblage for *Maireana pyramidata* Chenopod Shrubland within the Tonbridge survey area (Muir, 1977).

Life Form/ Height Class	Canopy Cover	Dominant species present
Tree <5 m	2-10%	<i>Acacia aneura</i>
Shrubs 1.5-2m	10-30%	<i>Maireana pyramidata</i>
Shrubs 0.5-1	2-10%	<i>Ptilotus obovatus</i> <i>Scaevola cuneata</i>

According to the ANRA this vegetation group is best represented by the Chenopod shrub vegetation group, which covers 7.6% of Western Australia (ANRA, 2010).

No broad scale clearing has occurred for agricultural purposes in this community within the survey area.



Figure 15: Image of *Maireana pyramidata* Chenopod Shrubland within the Tonbridge survey area.

8.4 *Maireana sedifolia* Chenopod Shrubland

8.4.1 Flora

Flora recorded in this vegetation group are represented by 14 Families, 18 Genera and 26 Species.

No DRF species or Priority flora pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* and as listed by the DEC (Atkins, 2010) were recorded within this vegetation group.

The weed species *Citrullus lanatus* was found in this vegetation group, however it is not listed as a Declared weed (DAFWA, 2010).

8.4.2 Vegetation

The upper-storey comprised of *Santalum lanceolatum*, *Acacia aneura*, *Acacia burkittii*, *Acacia tetragonophylla* and *Hakea preissii*. The middle canopy included *Maireana sedifolia*, *Maireana pyramidata*, *Pittosporum angustifolium*, *Themeda triandra* and *Eremophila longifolia*. The lower-storey included *Scaevola spinescens*, *Eremophila clarkei* and *Solanum ferocissimum*. Dominant species from the vegetation assemblage according to Muir (1977) is shown in Table 17.

Table 17: Vegetation assemblage for *Maireana sedifolia* Chenopod Shrubland within the Tonbridge survey area (Muir, 1977).

Life Form/ Height Class	Canopy Cover	Dominant species present
Tree < 5 m	2-10%	<i>Acacia aneura</i>
Shrubs 0.5-1m	10-30%	<i>Maireana sedifolia</i>
Shrubs 0-0.5m	2-10%	<i>Ptilotus obovatus</i> <i>Scaevola cuneata</i>

No broad scale clearing for agricultural purposes has occurred in this vegetation group within the survey area.

According to the ANRA this vegetation group is best represented by the Chenopod shrub vegetation group, which covers 7.6% of Western Australia (ANRA, 2010).



Figure 16: Image of *Maireana sedifolia* Chenopod Shrubland within the Tonbridge survey area.

8.5 Vegetation and Flora of Conservation Significance

None of the five vegetation groups have regional environmental significance as defined by the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* (DEWHA, 2010). There were no TEC's as defined by the *EPBC Act* or listed by the DEC found within the survey area (DEWHA, 2010; DEC, 2010).

No DRF or Priority flora were recorded in the survey area.

8.6 Vegetation condition

The survey area is made up of five vegetation groups. All have been classed as being in a “good” health condition (Keighery, 1994). This designation indicates that the vegetation structure has been affected by multiple disturbances, however still retains its basic structure and has the ability to regenerate. A description of the Keighery Health ratings are found in Appendix 6.

9 Introduced Plant Species

Four weed species, *Carthamus lanatus* (Saffron thistle) (P3), *Citrullus lanatus*, *Salvia verbenaca* and *Lysimachia arvensis* were recorded during the survey. Two species; *Citrullus lanatus* and *Lysimachia arvensis* were recorded within the Creepline vegetation and are not listed as Declared Weeds by the Department of Agriculture and Food WA (DAFWA). The remaining two species, *Salvia verbenaca* and *Carthamus lanatus* were located within the Mulga woodland vegetation group. *Carthamus lanatus* (P3) (Saffron thistle) is listed as a Declared Weed (DAFWA, 2010) and was recorded within the Million Dollar and Tonbridge survey areas. A full description of the declared status of this species is provided in Appendix 5.

- ***Carthamus lanatus* (Saffron thistle) (P3)**

This species is described as an erect, spiny annual, herbaceous plant which grows between 0.15–0.7 metres high. Its leaves are rigid with numerous spiny lobes. It produces yellow flowers from December to April and occurs on a variety of soils. This species is a weed of crops, pastures & waste grounds (WAHERB, 2010).

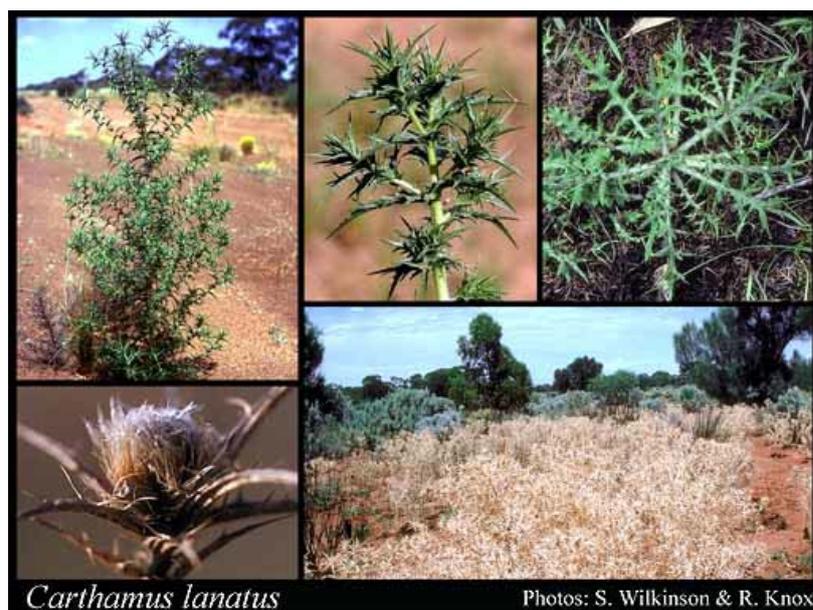


Figure 17: Image of *Carthamus lanatus* (WAHERB, 2010).

- ***Citrullus lanatus* (Pie Melon)**

This species is described as a trailing annual, herbaceous or climber weed that produces yellow flowers from January to December. It occurs on sandy, gravelly, loam or clay soils. It is found on plains, near river banks, in centres of dry lakes, along drainage areas and within disturbed areas (WAHERB, 2010).



Figure 18: Image of *Citrullus lanatus* (WAHERB, 2010).

- ***Salvia verbenaca***

This species is described as a slightly aromatic perennial herbaceous plant which grows between 0.1 to 1 metre high. It produces blue, pink or purple flowers in April and from July to October. It often occurs along roadsides (WAHERB, 2010).



Figure 19: Image of *Salvia verbenaca*.

- ***Lysimachia arvensis* (Pimpernel)**

No description available for this species (WAHERB 2010).



Figure 20: Image of *Lysimachia arvensis*

10 Relevant Legislation and Compliance with Recognised Standards

10.1 Commonwealth Legislation

Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The aim of this Act is to protect matters of national environmental significance and is used by the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) to list threatened species and ecological communities into categories based on the criteria set out in the Act (www.environment.gov.au/epbc/index.html). The Act provides a national environmental assessment and approval system for proposed developments and enforces strict penalties for unauthorised actions that may affect matters of national environmental significance.

The entire survey area has no regional significance as defined by the Act.

10.2 State Legislation

Clearing of Native Vegetation

The *Environmental Protection (Clearing of Native Vegetation) Regulations WA 2004* dictate that any clearing of native vegetation in Western Australia requires a permit from the Department of Environment and Conservation. Native vegetation includes aquatic and terrestrial vegetation indigenous to Western Australia, and intentionally planted vegetation declared by regulation to be native vegetation, but not vegetation planted in a plantation or planted with commercial intent (*Environmental Protection Act WA-Section 51A, 1986*). The *Environmental Protection Act WA 1986* Section 51A, defines clearing as: “the killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of substantial damage to some or all of the native vegetation in an area, including the flooding of land, the burning of vegetation, the grazing of stock or an act or activity that results in the above”

Under the *Environmental Protection (Clearing of Native Vegetation) Regulations WA 2004* - Regulation 6 – Environmentally sensitive areas (ESA) are “the area covered by vegetation within 50 m of Rare Flora, to the extent to which the vegetation is continuous with the vegetation in which the Rare Flora is located”. Ministerial approval must be granted prior to any clearing of Declared Rare Flora, including a minimum of 50m surrounding all populations of Rare Flora. The area covered by a Threatened Ecological Community is also considered an ESA and therefore non-permitted, unless Ministerial approval is granted. Exploration Activities are exempt from requiring clearing permits when undertaken via a Mining Act approval process such as “Programme of Work” provided the area does not occur in an ESA.

The entire survey area is not located within an ESA.

Environmental Protection Act WA 1986

This Act pertains to the assessment of applications for clearing permits and aims to protect Declared Rare Flora and Threatened Ecological Communities from clearing. Threatened Ecological Communities are protected even where exemptions for a clearing permit may apply. The Act enforces both financial and/or imprisonment penalties on those who unlawfully damage a Threatened Ecological Community.

The entire survey area contains no TEC's as listed by the *EPBC Act 1999* (DEWHA, 2010) and the DEC (2010b). The entire survey area does not contain any Declared Rare Flora.

Wildlife Conservation Act WA 1950

This Act is used by the Western Australian Department of Environment and Conservation (DEC) to list flora taxa as being protected and the level of protection needed for such flora. Flora species are classified as 'Declared Rare Flora' when their populations are geographically restricted or are threatened by local processes. Under this Act all native flora (spermatophytes, pteridophytes, bryophytes and thallophytes) are protected throughout the State. Financial penalties are enforced under this Act if threatened plant species are collected without an appropriate licence.

DEC Priority lists

The DEC lists 'Priority' flora species which are under consideration for declaration as Rare Flora. Species classed as Priority 1-3 are in urgent need of further survey, whereas Priority 4 species only require monitoring every 5-10yrs.

The DEC also lists Priority Ecological Communities (PEC) which identifies those communities that may need monitoring before possible nomination for Threatened Ecological Community (TEC) status. These priority species and communities have no formal legal protection until they are endorsed by the Minister as being Declared Rare Flora and TEC's respectively.

Results of the DEC database search found that one Priority Flora species has the potential to occur in the area as it occurs 4km south-east of the Tonbridge survey area (Table 4). No DRF or Priority Flora species were recorded in the entire survey area. The entire survey area contains no PEC's or TEC's.

10.3 EPA Position Statements

The EPA develops Position Statements to inform the public about environmental issues facing Western Australia and the plans for the future to ensure protection and ecological sustainability of environmentally important ecosystems. It provides a set of principles to assist the public and decision-makers on their responsibilities for managing land with care.

These principles also provide the basis for the Environmental Protection Authority to evaluate and report upon achieving environmental and ecological sustainability, and the protection of natural resources.

Position Statement No. 2 *Environmental Protection of Native Vegetation in Western Australia* (EPA, 2000) outlines EPA policy on the protection of native vegetation in Western Australia, particularly in agricultural areas. It identifies basic elements that the EPA should consider when assessing proposals that impact on biological diversity. These include the following: comparison of all proposal options; avoidance of species and community extinctions; an expectation that implementing the proposal will not take a vegetation type below the “threshold level” of 30%; and that proponents should demonstrate that on- and off-site impacts can be managed.

The survey area does not contain any Declared Rare Flora or Threatened Ecological Communities suggesting that clearing within the project area will meet the EPA standards outlined in Position statement no. 2.

Position Statement No. 3 *Terrestrial Biological Surveys as an Element of Biodiversity Protection* outlines that the EPA adopted the definition of Biological Diversity and the Principles as defined in the *National Strategy for the Conservation of Australia’s Biological Diversity* (Commonwealth of Australia 1996); that the quality of information and scope of field surveys should meet standards, requirements and protocols as determined and published by the EPA; and the Interim Biogeographic Regionalisation of Australia (IBRA) should be used as the largest unit for EIA decision-making in relation to the conservation of biodiversity. The IBRA has identified 26 bioregions in the State which are affected by a range of different threatening processes and have varying levels of sensitivity to impact.

Terrestrial biological surveys should provide sufficient information to address both biodiversity conservation and ecological function values within the context of proposals and the results of surveys should be publicly available.

The flora survey of the study area was planned and implemented as far as practicable according to the Environmental Protection Authority (EPA) Guidance Statement No. 51 *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004). Also as suggested in the above Position Statement, the Interim Biogeographic Regionalisation of Australia was used in preparing the report to identify the Conservation status of the area and identify the main threats to the biodiversity of plant species in the region.

11 Conclusions and Recommendations

11.1 Conclusions

The entire survey area contained five vegetation groups: Creekline Vegetation, *Maireana pyramidata* Chenopod Shrubland, *Maireana sedifolia* Chenopod Shrubland, Mulga Woodland and *Casuarina pauper* Woodland. These vegetation groups comprised a total of 23 Families, 35 Genera and 51 Species (including subspecies and variants). No Declared Rare Flora or Priority Flora species were recorded within the survey area.

Four weed species, *Carthamus lanatus* (Saffron thistle) (P3), *Citrullus lanatus*, *Salvia verbenaca* and *Lysimachia arvensis* were recorded during the survey. Two of these species; *Lysimachia arvensis* and *Citrullus lanatus* were recorded within the Creekline vegetation and are not listed as a Declared Weed by the Department of Agriculture and Food WA (DAFWA). Creekline vegetation was identified within all four survey areas. The remaining two weed species are *Salvia verbenaca* and *Carthamus lanatus* (P3) (Saffron thistle) were found in the Mulga Woodland vegetation group located within the Million Dollar and Tonbridge survey area. A full description of the Declared status of this species is provided in Appendix 5.

According to the Protected Matters Search Tool (DEWHA, 2010) the survey area has no regional environmental significance as defined by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

No Threatened Ecological Communities (TEC's) or Priority Ecological Communities (PEC's) listed under the *EPBC Act 1999* are known to occur in the survey area (DEWHA, 2010).

11.2 Recommendations

- As there have been weeds identified within all four survey areas all machinery moving entering the Million Dollar, Enterprise Haul road, Margaret and Tonbridge area should be cleaned down prior to entering these different sites and after leaving these sites to prevent further spread of weed species.
- Refer to the Department of Agriculture and Food WA website for information on managing the Declared Weed species *Carthamus lanatus* (see Appendix 5).
- Topsoil should be removed from the survey areas prior to clearing and stored for use in rehabilitation after work in the areas has been completed.
- Consultation with the DEC is required prior to any clearing within areas growing, in, or in association with, an environment associated with a watercourse or wetland. Creekline vegetation was identified within all four survey areas.

For the purpose of this vegetation survey BC submits the following comments regarding the clearing principles specifically related to native vegetation:

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

According to the DEC the Murchison subregion contains rich and diverse flora dominant by Mulga (*Acacia aneura* woodlands) however most species are wide ranging and usually occur in at least one, and often several, adjoining subregions (IBRA, 2001).

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

No DRF species were recorded within the survey area.

c. **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 (TEC).**

No Threatened Ecological Communities (TEC's) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (DEWHA, 2010) or by the DEC (2010b) occur in the survey area.

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

No vegetation considered as a significant remnant of extensively cleared vegetation was recorded in the survey area.

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

Creepline vegetation was identified within all four survey areas. Consultation with the DEC is required prior to any clearing within these areas identified by BC.

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

The survey area is not located within a conservation area; however Goongarrie National Park (Class A) occurs approximately 55km to the south west of the Million Dollar survey area.

The Goongarrie National Park is listed by the IUCN (International Union for Conservation of Nature) as Category II. The definition of a Category II Protected area is 'protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities'.

Due to the localized nature of the proposed clearing and the distance between the entire survey area and the Goongarrie National Park clearing of vegetation within the survey areas is not likely to have an impact on any nearby Conservation areas.

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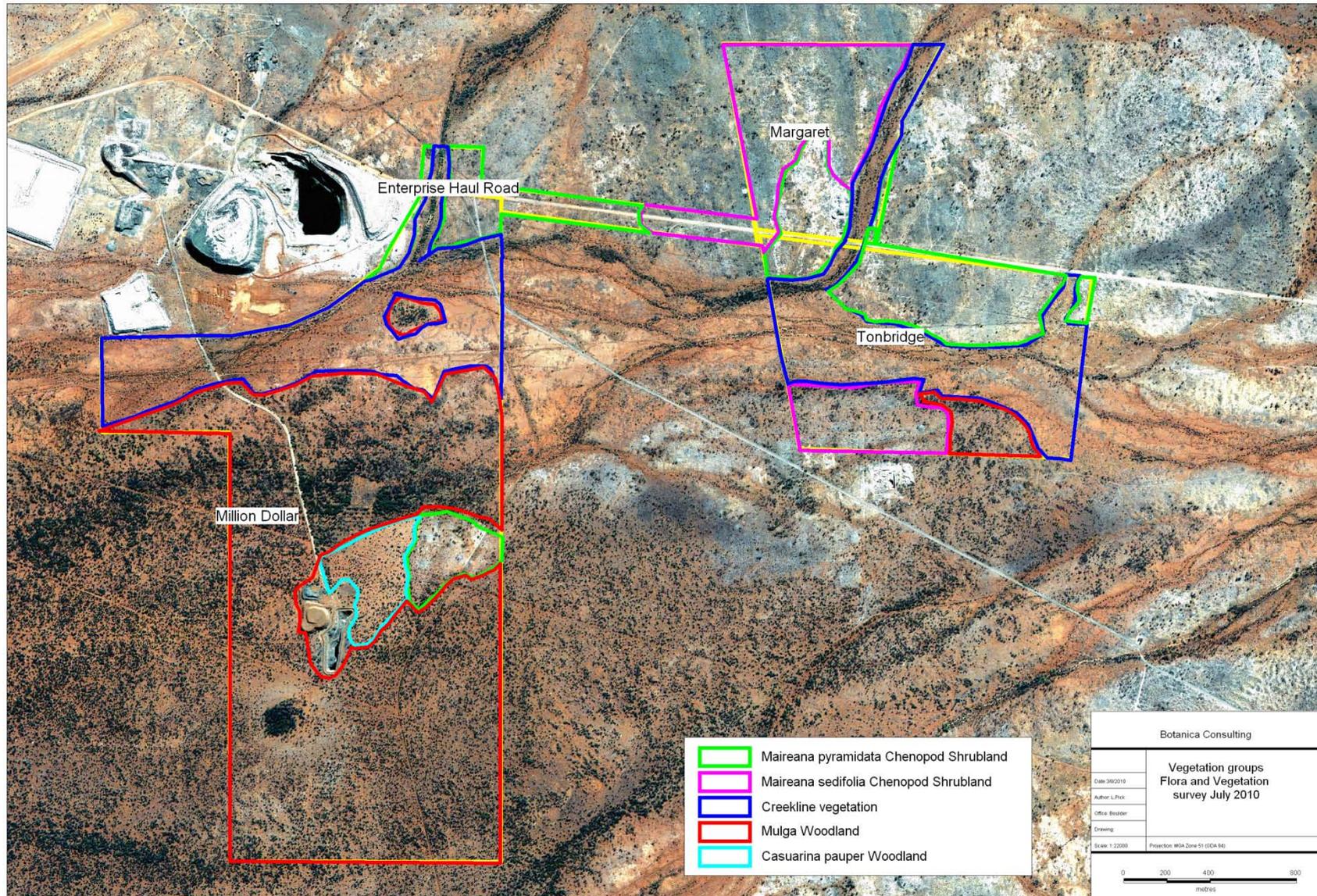
<http://florabase.dec.wa.gov.au>

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Appendix 1: Regional Map of the entire survey area including DEC known Priority Flora locations in proximity to the survey areas (survey areas not to scale).



Appendix 2: Vegetation Map of the entire survey areas (Million Dollar, Enterprise Haul Road, Margaret and Tonbridge area).



Appendix 3: Species list of the entire survey area (Million Dollar, Enterprise Haul Road, Margaret and Tonbridge area) per vegetation group.

Family	Genus	Species	Creeklime Vegetation	<i>Maireana pyramidata</i> Chenopod Shrubland	<i>Maireana sedifolia</i> Chenopod Shrubland	Mulga Woodland	<i>Casuarina pauper</i> Woodland
Amaranthaceae	<i>Ptilotus</i>	<i>obovatus</i>	*	*	*	*	*
Asteraceae	<i>Carthamus</i>	<i>lanatus</i> *				*	
Asteraceae	Germinant	sp. (sterile)	*			*	
Casuarinaceae	<i>Casuarina</i>	<i>pauper</i>		*	*	*	*
Chenopodiaceae	<i>Atriplex</i>	<i>bunburyana</i>	*	*	*		
Chenopodiaceae	<i>Enchylaena</i>	<i>tomentosa</i>				*	
Chenopodiaceae	<i>Maireana</i>	<i>georgei</i>	*	*	*	*	
Chenopodiaceae	<i>Maireana</i>	<i>sedifolia</i>		*	*	*	*
Chenopodiaceae	<i>Maireana</i>	<i>triptera</i>	*	*	*	*	
Chenopodiaceae	<i>Maireana</i>	<i>pyramidata</i>	*	*	*	*	*
Chenopodiaceae	<i>Rhagodia</i>	<i>eremaea</i>		*	*		
Chenopodiaceae	<i>Sclerolaena</i>	<i>cuneata</i>		*	*		
Convolvulaceae	<i>Duperreya</i>	<i>commixta</i>				*	
Cucurbitaceae	<i>Citrullus</i>	<i>lanatus</i> *	*	*	*		
Euphorbiaceae	<i>Euphorbia</i>	<i>drummondii</i>				*	
Fabaceae	<i>Acacia</i>	<i>aneura</i>		*	*	*	*
Fabaceae	<i>Acacia</i>	<i>aneura</i> var. <i>argentea</i>				*	
Fabaceae	<i>Acacia</i>	<i>burkittii</i>	*	*	*		
Fabaceae	<i>Acacia</i>	<i>craspedocarpa</i>				*	
Fabaceae	<i>Acacia</i>	<i>kempeana</i>				*	
Fabaceae	<i>Acacia</i>	<i>ramulosa</i>				*	
Fabaceae	<i>Acacia</i>	<i>tetragonophylla</i>	*	*	*	*	
Goodeniaceae	<i>Scaevola</i>	<i>spinescens</i>		*	*	*	
Haloragaceae	<i>Haloragis</i>	<i>trigonocarpa</i>				*	
Juncaceae	<i>Juncus</i>	<i>aridicola</i>				*	
Lamiaceae	<i>Salvia</i>	<i>verbenaca</i> *				*	
Lamiaceae	<i>Spartothamnella</i>	<i>teucriflora</i>				*	
Malvaceae	<i>Brachychiton</i>	<i>gregorii</i>				*	
Malvaceae	<i>Sida</i>	<i>calyxhymenia</i>	*			*	

Family	Genus	Species	Creekline Vegetation	<i>Maireana pyramidata</i> Chenopod Shrubland	<i>Maireana sedifolia</i> Chenopod Shrubland	Mulga Woodland	<i>Casuarina pauper</i> Woodland
Myrtaceae	<i>Eucalyptus</i>	<i>oleosa</i>				*	
Myrtaceae	<i>Eucalyptus</i>	<i>torquata</i>		*			
Pittosporaceae	<i>Pittosporum</i>	<i>angustifolium</i>		*	*		
Poaceae	(germinants)	sp. (sterile)		*	*	*	*
Poaceae	<i>Themeda</i>	<i>triandra</i>		*	*		
Primulaceae	<i>Lysimachia</i>	<i>arvensis</i> *	*				
Proteaceae	<i>Grevillea</i>	<i>berryana</i>				*	
Proteaceae	<i>Hakea</i>	<i>preissii</i>		*	*		*
Pteridaceae	<i>Cheilanthes</i>	<i>sieberi</i> subsp. <i>sieberi</i>	*			*	
Santalaceae	<i>Exocarpos</i>	<i>aphyllus</i>				*	*
Santalaceae	<i>Santalum</i>	<i>lanceolatum</i>	*	*	*		
Santalaceae	<i>Santalum</i>	<i>spicatum</i>	*				
Sapindaceae	<i>Dodonaea</i>	<i>lobulata</i>		*	*	*	*
Scrophulariaceae	<i>Eremophila</i>	<i>clarkei</i>		*	*		
Scrophulariaceae	<i>Eremophila</i>	<i>forrestii</i>					*
Scrophulariaceae	<i>Eremophila</i>	<i>gilesii</i> subsp. <i>gilesii</i>				*	
Scrophulariaceae	<i>Eremophila</i>	<i>latrobei</i>				*	
Scrophulariaceae	<i>Eremophila</i>	<i>longifolia</i>	*	*	*	*	
Scrophulariaceae	<i>Eremophila</i>	<i>scoparia</i>		*	*		
Scrophulariaceae	<i>Eremophila</i>	<i>homoplastica</i>				*	
Solanaceae	<i>Solanum</i>	<i>lasiophyllum</i>		*	*		
Solanaceae	<i>Solanum</i>	<i>ferocissimum</i>		*	*		

*denotes weed species

Appendix 4: Results of the DEC database search (DEC, 2010).

Species	Priority	Description (WAHERB, 2010)
<i>Thryptomene eremaea</i>	2	Erect open shrub, 0.5–1.5 m high. Fl. pink, white, Jul–Sep. Red or yellow sand. Sandplains.

Appendix 5: Results of Declared Weed Database search (DAFWA, 2010).

Weed Description: <i>Carthamus lanatus</i> (Saffron thistle)	
Family:	Asteraceae
Form:	Herbaceous – Annual
Status:	Present in WA
<p>Saffron thistle is an erect annual thistle to 1 m (rarely to 1.5m) high, native from southern Europe and the Mediterranean to central Asia. It is now widespread in parts of the cereal growing pastoral areas (Goldfields) in Western Australia. It is a hardy weed of cultivation that displaces more useful species in poor pasture and is arguably the most widespread thistle in Australia. It is only considered an important weed in Australia. The spines contaminate wool, and make handling contaminated sheep painful. It is seldom eaten, but its seeds are oil and protein rich. The plant matures with cereal crops and seed is harvested with the grain, and this is one of the main methods of spread. Dry seeds tangle in wool.</p> <p>Wheat contaminated with saffron thistle seed is liable to dockage.</p>	
Stems:	Stiff, ribbed, branched above, hairless to downy. Stems round in cross-section
Leaves:	Variable; basal leaves in a rosette, lanceolate, initially with few lobes but older leaves more dissected, to 20 cm long and to 5 cm wide; stem leaves to 11 cm long and to 5 cm wide, usually hairless but some plants with hairy leaves, base stem-clasping and not on a leaf stalk. Mature leaves are stiff.
Flowers:	In solitary heads to 2 cm wide, surrounded by stiff spiny bracts (involucral bracts) to 5 cm long. Heads made up of small flowers (florets) to 3 cm long. All florets are tubular and yellow. Flowers late spring to autumn.
Seeds:	Seeds ovoid, grey-brown, 4–6 mm long, about 3 mm wide, hairless, 4-angled, apex with linear scales to 1 cm long.

Priority Categories according to region

Category: P3
Location: For the municipal districts of Albany (C), Augusta-Margaret River (S), Broomehill (S), Bunbury (C), Busselton (S), Capel (S), Carnamah (S), Collie (S), Coorow (S), Cranbrook (S), Cunderdin (S), Dardanup (S), Denmark (S), Donnybrook-Balingup (S), Dowerin (S), Dumbleyung (S), Gnowangerup (S), Harvey (S), Katanning (S), Kellerberrin (S), Kojonup (S), Koorda (S), Mandurah (C), Mount Marshall (S), Murray (S), Plantagenet (S), Serpentine-Jarrahdale (S), Tambellup (S), Tammin (S), Trayning (S), Wagin (S), Waroona (S), West Arthur (S), Woodanilling (S), Wyalkatchem (S).
Category: P1
Location: for the whole of the State
Category: P4
Location: For the municipal districts of Ashburton (S), Beverley (S), Boddington (S), Brookton (S), Broome (S), Bruce Rock (S), Carnarvon (S), Chittering (S), Coolgardie (S), Corrigin (S), Cuballing (S), Cue (S), Dalwallinu (S), Dandaragan (S), Derby-West Kimberley (S), Dundas (S), East Pilbara (S), Esperance (S), Exmouth (S), Gingin (S), Goomalling (S), Halls Creek (S), Jerramungup (S), Kalgoorlie/Boulder (C), Kent (S), Kondinin (S), Kulin (S), Lake Grace (S), Laverton (S), Leonora (S), Meekatharra (S), Menzies (S), Merredin (S), Moora (S), Mount Magnet (S), Mukinbudin (S), Murchison (S), Narembeen (S), Narrogin (S), Ngaanyatjaraku (S), Northam (S), Northam (T), Nungarin (S), Pingelly (S), Port Hedland (T), Quairading (S), Ravensthorpe (S), Roebourne (S), Sandstone (S), Shark Bay (S), Toodyay (S), Upper Gascoyne (S),

Victoria Plains (S), Wandering (S), Westonia (S), Wickepin (S), Williams (S), Wiluna (S), Wongan-Ballidu (S), Wyndham-East Kimberley (S), Yalgoo (S), Yilgarn (S), York (S).

Control Codes and Landholder Obligations

<p>P1 REQUIREMENTS Prohibits movement</p>	<p>The movement of plants or their seeds is prohibited within the State.</p> <p>This prohibits the movement of contaminated machinery and produce including livestock and fodder.</p>
<p>P3 REQUIREMENTS Aims to control infestation by reducing area and/or density of infestation</p>	<p>The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery.</p> <p>Treat to destroy and prevent seed set all plants:</p> <ul style="list-style-type: none"> • within 100 metres inside of the boundaries of the infestation • within 50 metres of roads and high-water mark on waterways • within 50 metres of sheds, stock yards and houses <p>Treatment must be done prior to seed set each year. Properties with less than 20 hectares of infestation must treat the entire infestation.</p> <p>Additional areas may be ordered to be treated.</p>
<p>P4 REQUIREMENTS Aims to prevent infestation spreading beyond existing boundaries of infestation.</p>	<p>The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery.</p> <p>Treat to destroy and prevent seed set all plants:</p> <ul style="list-style-type: none"> • within 100 metres inside of the boundaries of the infested property • within 50 metres of roads and high-water mark on waterways • within 50 metres of sheds, stock yards and houses <p>Treatment must be done prior to seed set each year. Properties with less than 20 hectares of infestation must treat the entire infestation.</p> <p>Additional areas may be ordered to be treated.</p>
<p>Special considerations</p>	<p>In the case of P4 infestations where they continue across property boundaries there is no requirement to treat the relevant part of the property boundaries as long as the boundaries of the infestation as a whole are treated.</p> <p>There must be agreement between neighbours in relation to the treatment of these areas.</p>

Appendix 6: Keighery Health Rating Scale (Keighery, 1994).

Health Rating	Health Description	Definition
6	Pristine	No obvious signs of disturbance
5	Excellent	Vegetation intact despite disturbance affect, weeds are non-aggressive individual species
4	Very Good	Vegetation altered due to obvious signs of disturbance
3	Good	Structure affected multiple disturbances. Retains basic structure, has ability to regenerate
2	Degraded	Structure severely disturbed. Can regeneration to good condition, but requires intensive management
1	Completely Degraded	Completely bare no native species

Appendix 7: Muir (1977) Plant Life Form Classification.

LIFE FORM/HEIGHT CLASS	CANOPY COVER			
	DENSE 70% -100%	MID DENSE 30% -70%	SPARSE 10% -30%	VERY SPARSE 2% -10%
Trees > 30m Trees 15 – 30m Trees 5 – 15m Trees < 5m	Dense Tall Forest Dense Forest Dense Low Forest A Dense Low Forest B	Tall Forest Forest Low Forest A Low Forest B	Tall Woodland Woodland Low woodland A Low Woodland B	Open Tall Woodland Open Woodland Open Low Woodland A Open Low Woodland B
Mallee Tree Form Mallee Shrub Form	Dense Tree Mallee Dense Shrub Mallee	Tree Mallee Shrub Mallee	Open Tree Mallee Open Shrub Mallee	Very Open Tree Mallee Very Open Shrub Mallee
Shrubs > 2m Shrubs 1.5 – 2m Shrubs 1 – 1.5m Shrubs 0.5 – 1m Shrubs 0 – 0.5m	Dense Thicket Dense Heath A Dense Heath B Dense Low Heath C Dense Low Heath D	Thicket Heath A Heath B Low Heath C Low Heath D	Scrub Low Scrub A Low Scrub B Dwarf Scrub C Dwarf Scrub D	Open Scrub Open Low Scrub A Open Low Scrub B Open Dwarf Scrub C Open Dwarf Scrub D
Mat Plants Hummock Grass Bunch grass >0.5m Bunch grass < 0.5m Herbaceous spp.	Dense Mat Plants Dense Hummock Grass Dense Tall Grass Dense Low Grass Dense Herbs	Mat Plants Mid-dense Hummock Grass Tall Grass Low Gras Herbs	Open Mat Plants Hummock Grass Open Tall Grass Open Low Grass Open Herbs	Very Open Mat Plants Open Hummock Grass Very Open Tall Grass Very Open Low Grass Very Open Herbs
Sedges > 0.5m Sedges < 0.5m	Dense Tall Sedges Dense Low Sedges	Tall Sedges Low Sedges	Open Tall Sedges Open Low Sedges	Very Open Tall Sedges Very Open Low Sedges
Ferns Mosses, liverworts	Dense ferns Dense Mosses	Ferns Mosses	Open Ferns Open Mosses	Very Open Ferns Very Open Mosses

Appendix 8: GPS coordinates recorded within the entire survey area.

Way point	Zone	Easting	Northing
165	51 J	432536	6705248
166	51 J	433025	6705179
167	51 J	433272	6705354
168	51 J	433234	6705456
169	51 J	433602	6705875
170	51 J	434465	6704859
171	51 J	434370	6704742
172	51 J	434315	6704586
173	51 J	434190	6704248
174	51 J	434029	6704660
175	51 J	433815	6704603
176	51 J	433434	6704679
177	51 J	433020	6704163
178	51 J	433585	6704751
179	51 J	433141	6704896
180	51 J	431189	6704776
181	51 J	431427	6704198
182	51 J	431436	6703735
183	51 J	431486	6703551
184	51 J	431133	6702712
185	51 J	430775	6702947
186	51 J	430461	6703956
187	51 J	430800	6704010
188	51 J	430257	6704330
189	51 J	431216	6703488
190	51 J	431149	6703967

Appendix B: Vegetation, flora and fauna survey (AHA, 2023)

Environmental Assessment: Enterprise

Northern Star Resources Ltd.



Alexander Holm & Associates

Natural Resource Management Services

November 2023

Frontage image: Typical gently sloping landform and chenopod acacia vegetation within in the AE

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1. Summary

Northern Star Resources Ltd (Northern Star) operates the Porphyry Gold Mine and associated nearby satellite mines. Northern Star plans further mining operations at Enterprise, 2.5km east of Porphyry, requiring vegetation clearing.

Alexander Holm & Associates were contracted by Northern Star to conduct an environmental assessment of this area focussing on flora, fauna, vegetation and landscape characteristics.

The Assessment Envelope (AE) covers an area of 367ha which includes the completed Enterprise Gold Mine and associated infrastructure.

Landscape within the AE is widely and noticeably degraded most evident on alluvial flood plains associated with drainage tracts.

While flora composition and vegetation associations within the AE are degraded, they are typical of the region and not considered unusually diverse. There are no Threatened Ecological Communities (TECs) and no Priority Ecological Communities within or adjacent to the survey area.

No listed species of rare or critically endangered or priority listed flora or conservation listed fauna were found during this survey.

2. Scope of works

Northern Star Resources Ltd (Northern Star) operates the Porphyry Gold Mine and associated nearby satellite mines. Northern Star plans further mining operations at Enterprise, 2.5km east of Porphyry, requiring vegetation clearing.

Alexander Holm & Associates were contracted by Northern Star to conduct an environmental assessment of this area focussing on flora, fauna vegetation and landscape characteristics. Bamford Consulting Ecologists (BCE) were sub-contracted by Alexander Holm & Associates to undertake and report on the fauna component of the assessment. The Assessment Envelope (AE) covers an area of 367ha which includes the completed Enterprise Gold Mine and associated infrastructure.

The environmental assessment to include:

- A review of available information on likelihood of a) presence of threatened (rare) or priority plant species and b) threatened plant communities in the general search area.
- A reconnaissance level fauna, flora and vegetation survey.
- An assessment of soil type, landscape stability and condition.
- A description of land units and relate information on fauna, flora, vegetation communities, soil type and landscape stability to these units.
- Locations (if any) of priority and threatened flora/fauna.
- Map outputs provided in geo-referenced digital files and IBSA data sets.

- An integrated report covering flora, vegetation and fauna within a local and regional context.

The scope of works is to comply with Western Australian Environmental Protection Authority (EPA) objectives for protection of the environment specifically to “ensure that flora and vegetation surveys provide sufficient information to address both biodiversity conservation and ecological function values within the context of the type of proposal being considered” and to “enable an assessment of impacts on the conservation values and status of the site in a regional and local context” (Environmental Protection Authority, 2004).

Specifically the vegetation and flora survey is to be conducted in accordance with methods for reconnaissance surveys in EPA’s “Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (Environmental Protection Authority 2016)

The basic fauna survey is to be conducted in accordance with methods detailed in EPA’s Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment (Environmental Protection Authority 2020).

3. Regional Overview

3.1. Regional Setting

The Enterprise AE area is approximately 135km northeast of Kalgoorlie-Boulder in the state of Western Australia, and 5km west of Edjudina homestead (Figure 1). It is within the north-eastern Goldfields region, Menzies local government area, and within Edjudina pastoral lease. It is located in the east of Eastern Murchison (MUR 1) bio-geographic subregion (Cowan 2001; Desmond et al. 2003).

The most extensive land use in the region is pastoralism and over 80% of this region is pastoral leasehold. Most of the remainder is unallocated crown land and less than 1% is set aside for nature conservation.



Figure 1: Assessment area (in red) in relation to Lake Rebecca.

3.2. Climate

Rainfall in the region is unreliable and inconsistent. Winter rainfall consists of light showers from April to October. Significant summer rainfall events originating from the north-west as tropical cyclones are most likely between January and March.

The average potential pan evaporation rate is approximately 3200 mm per annum¹.

Winds are mostly light easterlies.

3.3. Topography and drainage

Landform patterns in the general area comprise extensive sand plain, sub-parallel greenstone belts and breakaways with often extensive lower pediments which give way to level to very gently inclined sheet flood plains. Relief is subdued. There are no major river systems. South-east trending, broad, saline, paleo-drainage systems traverse the region and are defining features of the Yilgarn block of south-western Australia (Gentili, 1979). These drainage systems have very low gradients and contain playa lakes including Lake Rebecca, Carey and Raeside. Lakes form local depo-centres with poorly developed radial drainage systems. During occasional intense rainfall events lakes may fill, and in very rare events some may overflow, link-up and discharge to the Nullarbor Plain through Ponton Creek (Pringle, Van Vreeswyk & Gilligan, 1994).

3.4. Hydrogeology

Groundwater occurs throughout the region within sparse fractures in basement rocks, within the weathering profile, and in alluvial sediments. Regional water table elevations vary from around 350 m above sea level around Lake Raeside to 400 – 450 m above sea level around Lake Carey and are generally 30 to 100 m below surface. Groundwater recharge occurs from major, but infrequent, rainfall events, mainly on drainage divides, and locally at site specific intake areas such as drainage lines or sandplains and dune fields. Groundwater is in hydraulic continuity and flows from drainage divides towards paleo-drainages and then south-easterly toward the Nullarbor Plain. Groundwater beneath catchment divides occurs as lenses of less than 5000 mg/l TDS which are superimposed on a regional field of saline groundwater with linear bodies of hypersaline groundwater along paleo-drainages, and local brine pools associated with salt lakes.

3.5. Vegetation and soils

The region lies within the Eremaean botanical province, mainly in the Austin botanical district (Beard, 1976). Lake Ballard/Lake Rebecca form a major vegetation divide with characteristic *Acacia aneura* (mulga) low woodlands associated with red loams over siliceous hardpan to the north and low woodlands of mixed mulga and *Casuarina pauper* (black oak) and *Eucalyptus* species on alkaline and calcareous soils to the south. Spinifex hummock grassland with eucalypt overstory on sand plain is common. Halophytic vegetation occurs throughout the region on paleo-drainage systems, breakaways and on some stony and alluvial plains. Highly saline soils support *Atriplex* (saltbush), *Maireana* (bluebush) and *Tecticornia* (samphire) shrublands, while less saline soils support eucalypt or mulga with saltbush or bluebush understoreys.

¹ http://www.bom.gov.au/cgi-bin/climate/cgi_bin_scripts/evaporation.cgi.

Vegetation associations in the project area include Beard Vegetation³⁸⁹ (Succulent steppe with open low woodland; mulga over salt bush) and 400 (Succulent steppe with open low woodland; mulga over bluebush).

4. Assessment methodology

4.1. Assessment personnel

The work was managed and conducted by Dr Alexander Holm (Alexander Holm & Associates). Dr Holm is an ecologist with over 35 years-experience in arid environments and Goldfield regions and an accredited environmental consultant with the Environmental Consultants Association of Western Australia.

Mr Geoffrey Eliot handled soil characterisation and erosion assessment during survey. Mr Eliot was soil and landscape technician for the Western Australian Department of Agriculture's rangeland surveys and has over 20 years-experience in Western Australian arid regions.

Field work for the vegetation and flora surveys was conducted by Mr Eliot and Dr Holm.

Andrew Mitchell was assisting botanist to Western Australian Department of Agriculture's rangeland survey and senior author of "Arid Shrubland Plants of Western Australia" (Mitchell and Wilcox 1994). Mr Mitchell provided off-site assistance in expert identification of flora specimens collected in the field.

Dr Mike Bamford is a wildlife biologist, scientific illustrator and science communicator and with his wife Mandy, he has operated Bamford Consulting Ecologists since the mid 1980s. The business specialises in fauna investigations for Environmental Impact Assessment and to meet conditions of approval, such as monitoring of impacts and monitoring of rehabilitation. Some work is also done on environmental education and interpretation. Mike has extensive experience in the south-west of Western Australia, Western Australia's Goldfields, Pilbara, Kimberley, the Western Deserts, the Northern Territory, Christmas Island and far north Queensland.

Mr Peter Smith has 30 years of experience for environmental surveys, including Malleefowl surveys and specialises in searches for rare trapdoor spiders.

Field work for the fauna survey was conducted by Peter Smith and Rifka McClure under direction of Dr Mike Bamford of Bamford Consulting Ecologists.

4.2. License

Alexander Holm holds a "Flora taking (Biological Assessment) License" FB62000365, issued by the Department of Biodiversity, Conservation and Attractions and valid until August 19, 2024.

4.3. Timing of survey and seasonal conditions

Vegetation and flora survey was from October 10 -11, 2023 and the fauna survey on October 27, 2023.

Rainfall at Edjudina (5km southeast of Enterprise) averages 221 mm a year and in recent years, summer-rainfall has become more prevalent. Rainfall in 2019 (59mm) was the lowest on record. Rainfall in 2020 (182mm) and 2021 (179mm) was below average

(Figure 2). Rainfall in 2022 (143mm) was again well below average with only 114mm falling to date in 2023.

Few perennials were flowering; however some species had set seed. Annual and biannual species were sparse and mostly located in water-favoured locations.

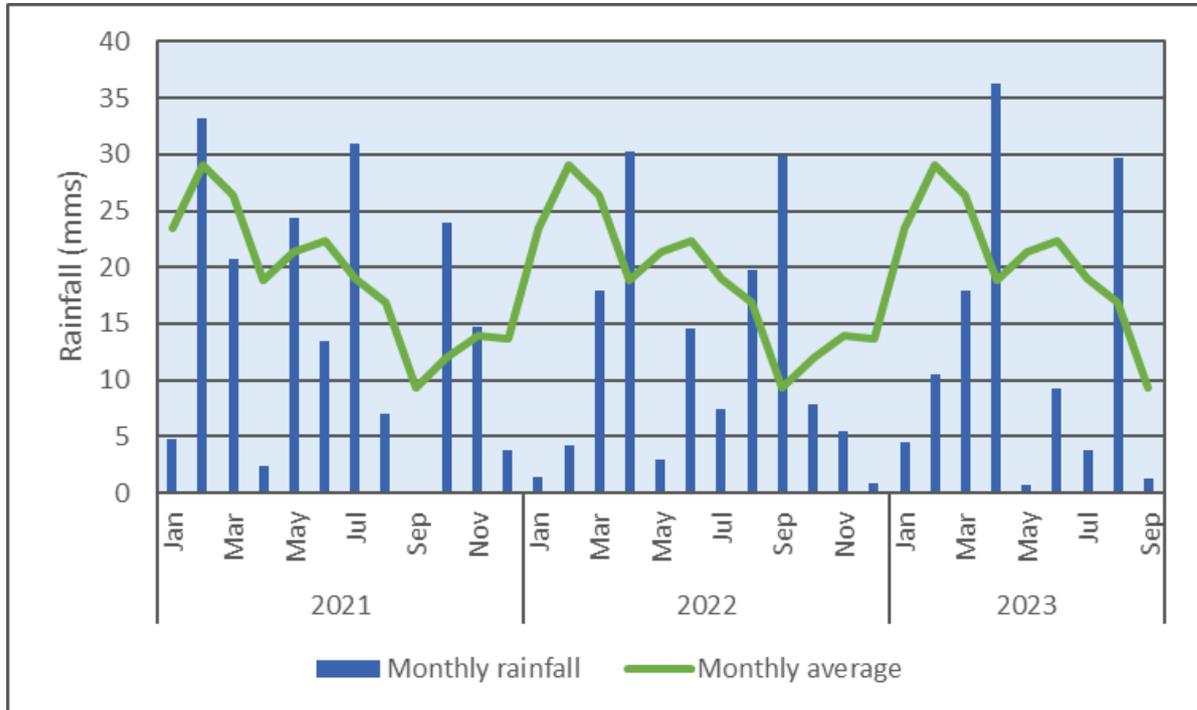


Figure 2: Monthly rainfall at Edjudina.

4.4. Declared Flora and Fauna

4.4.1 WA conservation listed species.

The Species and Communities interim “NatureMap” search service provided records of all conservation listed flora and fauna within a 40 km radius of the study area (DCBA search reference number: 35-0923NM). The following flora and fauna were identified:

Thryptomene eremaea, a Priority 2 taxon is an erect open shrub, 0.5 to 1.5m high, and grows on red or yellow sands on sandplains and shallow sandy soils over granite.

Tecticornia mellarium, a Priority 1 taxon growing on salt lake margins.

Tecticornia sp. Lake Way (P. Armstrong 05/961) a Priority 1 taxon growing on salt lake margins.

Eremophila arachnoides subsp. *tenera*, a Priority 3 taxon is an erect shrub, 0.5 to 2m high producing blue flowers growing on saline alluvial plains.

Acacia eremophila var. Numerous-nerved variant (A.S. George 11924): a Priority 3 taxon, is a dense, spreading shrub, 1-2 m high. producing yellow flowers in September and grows on sandy soils on flats.

Leipoa ocellata (Malleefowl) is listed as Vulnerable.

Aspidites ramsayi (Woma python) southwest subpopulation); a Priority 1 taxon.

4.4.2 EPBC Act protected matters

The Commonwealth Department of Climate Change Energy Environment and Water's protected matters search tool was used to identify all matters protected under the EPBC Act within a 50km radius of the AE2 (**Error! Reference source not found.**).

No flora of significance were identified.

Six birds, listed as threatened species, were identified as possible residents:

Aphelocephala leucopsis (Southern Whiteface) – Vulnerable

Calidris ferruginea (Curlew Sandpiper) – Critically endangered.

Falco hypoleucos (Grey Falcon) – Vulnerable

Leipoa ocellata (Malleefowl) – Vulnerable

Pezoporus occidentalis (Night Parrot) – Endangered

Polytelis alexandrae (Princess Parrot) – Vulnerable.

Of these, (*Calidris ferruginea*) is a critically endangered migratory wetland species and as there are no wetlands it is unlikely to be present.

4.4.3 Flora surveys

The following flora surveys from the general area were reviewed for records of declared flora and to assess likelihood of occurrence in the survey area:

Supporting information for clearing permit applications associated with re-opening of the Porphyry mine site. Saracen 2007.

No Threatened or Priority Flora were recorded.

Enterprise clearing permit application – supporting information. Saracen 2008.

No Threatened or Priority Flora were recorded.

Environmental assessment for proposed Yarri road diversion Porphyry-Enterprise. Alexander Holm & Associates 2009.

No Threatened or Priority Flora were recorded.

Environmental assessment: proposed Wallbrook mine sites and surrounds. Saracen Gold Mines. Alexander Holm & Associates 2009.

No Threatened or Priority Flora were recorded.

Level 1 Flora and vegetation survey of tenements associated with development of Million Dollar Mine and associated infrastructure. Botanica Consulting 2010.

No Threatened or Priority Flora were recorded.

Vegetation assessment within expanded Porphyry Mine clearing envelope. Northern Star Resources. Alexander Holm & Associates 2021

No Threatened or Priority Flora were recorded.

Environmental assessment: Muduwongga Lake Rebecca. Northern Star Resources. Alexander Holm & Associates 2023.

² [Protected Matters Search Tool - DCCEEW](#)

Two significant collections were made:

1. *Tecticornia* sp. Nov. (Lake Rebecca) is likely to be locally endemic and appears to be an undescribed species requiring further collections and study.
2. A single collection of *Tecticornia mellarium*, a priority 1 taxon. This collection varied significantly from the type specimens and is possibly a taxonomic variant requiring further study (Kelly Shepherd pers com).

These specimens were collected on saline flats associated with Lake Rebecca. No similar land form occurs on the AE.

4.5. Threatened and priority ecological communities

The likelihood of presence of threatened ecological communities within the general survey area was assessed using the protected matters search tool (Attachment 2).

Other threatened ecosystems in the south-east of Eastern Murchison (MUR 1) biogeographic subregion, identified during “A Biodiversity Audit of Western Australia’s 53 Biogeographical Subregions in 2002”, are listed in Cowan (2001).

Priority ecological communities in the area were assessed from Department of Parks and Wildlife listing (Version 34, December 21, 2022).

4.6. Land systems land units and vegetation communities

Land systems and land units were derived from a land resource survey of northeastern Goldfields (Pringle, Van Vreeswyk & Gilligan, 1994).

Vegetation communities were established firstly with reference to those listed in Pringle et al. (1994) where they are listed as ‘site types’, and secondly, where no comparable community could be found, with reference to those listed in adjacent surveys of Sandstone, Yalgoo Paynes Find (Payne et al., 1998) and Kambalda north (Payne, Mitchell & Hennig, 1998).

Tentative land units were identified by examination of high-resolution aerial photography and extrapolation from adjoining or nearby surveys (Figure 3). Boundaries were checked in the field, transferred to geo-referenced ortho-photo maps and captured digitally. Vegetation communities were visually associated with each land unit.

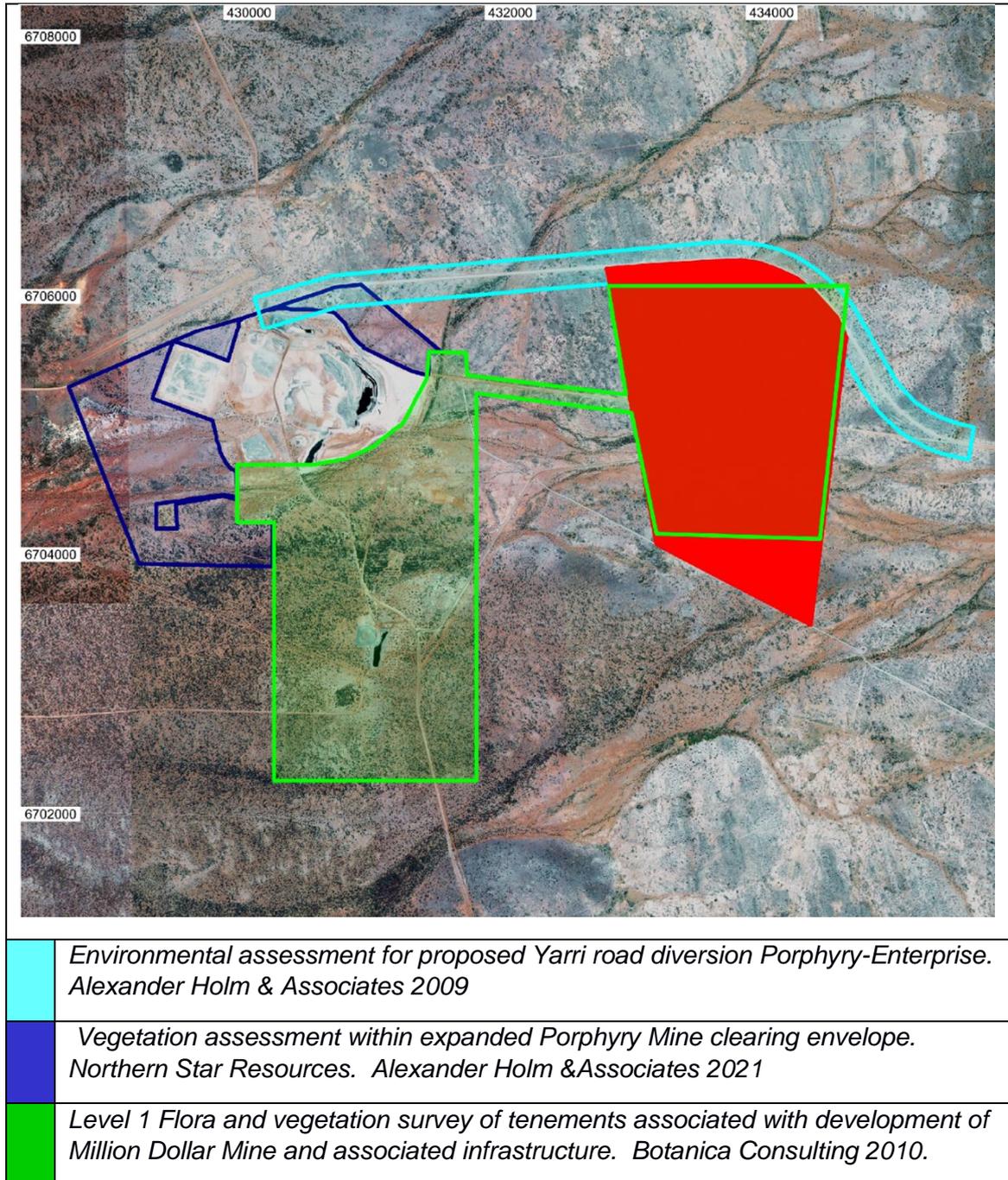


Figure 3: Proposed Assessment Area (red) and locations of existing flora and vegetation surveys.

4.7. Field survey

4.7.1 Vegetation and flora survey

The survey and reporting were conducted to comply with the EPA's "Technical Guidance – flora and vegetation surveys for environmental impact assessment" (Environmental Protection Authority 2016). A reconnaissance level survey was considered appropriate in the first instance in view of results of several vegetation and flora surveys in or adjacent to the study area.

Twenty one inventory sites (relevés) were selected to 1) sample each land unit within the survey area, 2) provide systematic coverage of the survey area, and 3) to encompass variations in pattern within each land unit (Figure 4). Each inventory site was located by GPS and the following information recorded:

- Digital photographs.
- All flora species within approximately 50 m of a central location and in the same land unit were inventoried and voucher specimens collected of all unknown taxa.
- Vegetation condition were visually estimated using rating scales of Environmental Protection Authority (2016) and soil erosion described.
- Vegetation community and land unit descriptions using terminology from Payne et al. (1998).
- Vegetation cover, landform, slope, relief, surface coarse fragment characteristics and surface water flow characteristics (Anon, 2009).
- Soil characteristics (texture, reaction to acid and fragment characteristics to maximum of 30cm (Anon, 2009).

4.7.2 Priority flora

Of the priority flora known to occur in the general area as listed in 4.4, habitat within the AE maybe suitable for the following:

- *Eremophila arachnoides* subsp. *tenera*, on saline alluvial plains.
- *Acacia eremophila* var. Numerous-nerved variant (A.S. George 11924) growing on sandy soils.
- *Thryptomene eremaea* growing on granitic soils.

Habitat likely to support these species was afforded extra attention through foot traverse during survey (Figure 4) and field collections made of all unknown or uncertain specimens for later expert identification.

4.7.3 Reconnaissance Fauna Survey

The site visit involved looking around as much of the AE as possible in daylight; as shown in Figure 4 In general, walks were unstructured and two personnel travelled 20-40m apart, with the track determined by areas of interest, requirement to traverse all land units and intended to cover as much ground as possible.

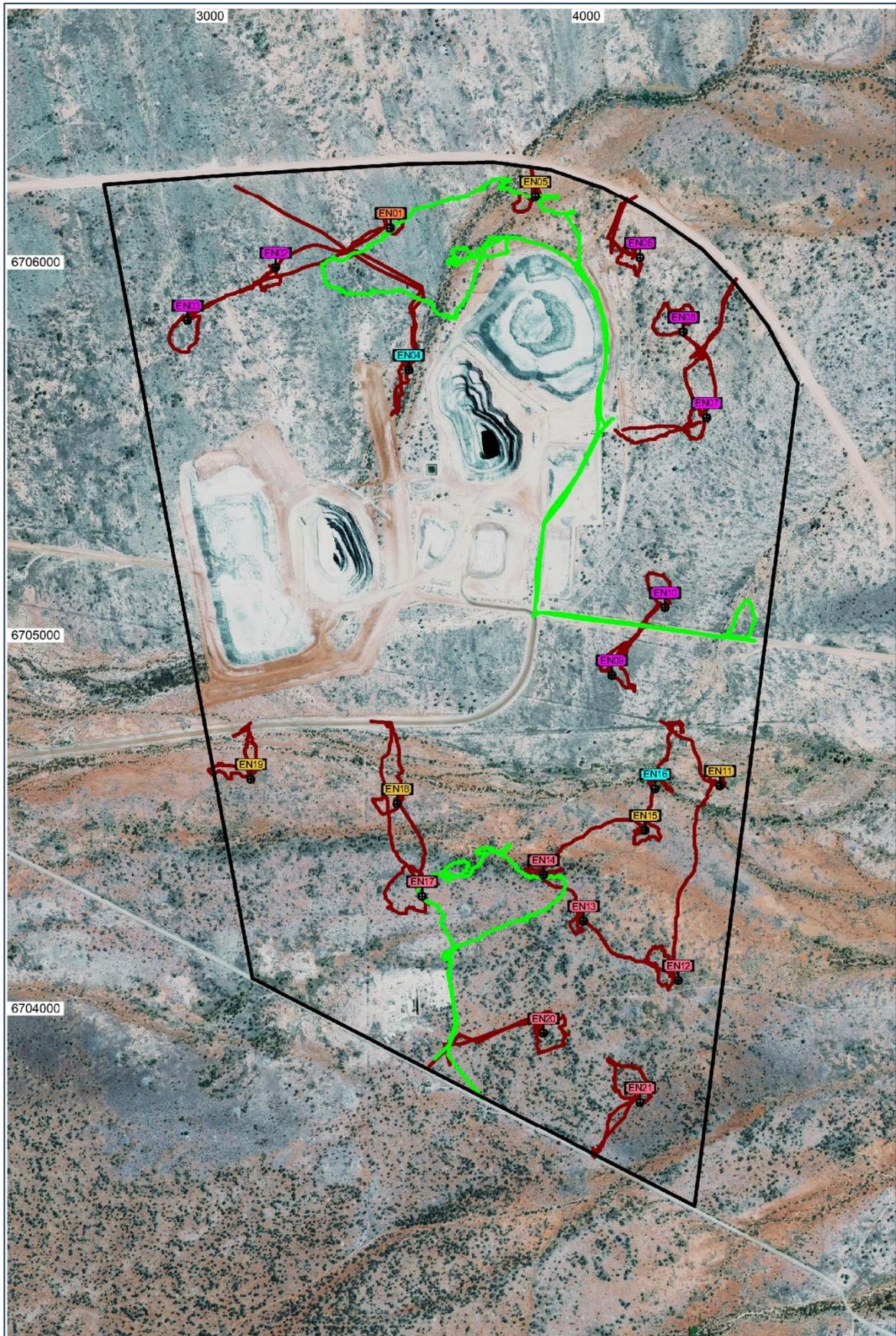


Figure 4: Enterprise AE with location of inventory sites and ground traverse flora (red) and fauna (green) during survey.

5. Environmental analysis

5.1. Vegetation associations

Beard Vegetation Association 400 (Succulent steppe with open low woodland; mulga over bluebush) occupies 100% of the AE (Beard 1976).

5.2. Land systems and landforms

Extensive gently undulating plains on weathered greenstones supporting bluebush shrublands of Gundockerta land system occupies 100% of the AE (Pringle et al. 1994).

5.3. Land units, soil types and vegetation communities

5.3.1 Land unit descriptions and mapping

Five land units, associated vegetation communities and soil types are described in Table 1 and mapped in Figure 5.

Table 1: Land unit descriptions, their soil type, vulnerability to erosion and associated vegetation communities.

Land unit	Land form and soil type	Vegetation community
2b. Low rises on volcanics with chenopod shrublands		
	<p>Gently inclined rises to ~10m with moderate mantles of shale and quartz fragments. Skeletal shale outcrops.</p> <p>Variable depth calcareous sandy loams gradational to sandy clay loams.</p> <p>Run –off zones with diffuse overland flow and minor concentrated flow zones.</p> <p>Extensive deflated surfaces. Slight vulnerability to erosion.</p>	<p>Sparse degraded chenopod shrubland dominated by <i>Maireana sedifolia</i> with isolated taller shrubs <i>Acacia burkittii</i> and <i>Senna artemisioides</i> subsp. <i>filifolia</i>.</p> <p>“Calcyphytic pearl bluebush shrubland”</p> <p>(CPBS vegetation community).</p>
3a. Granitic plains supporting acacia shrublands		
	<p>Very gently inclined to near level plains (slopes <1.5%); mostly sparse to moderate mantles of quartz fragments.</p> <p>Variable depth non-calcareous sandy clay loams in places over calcrete or ferruginous hardpan.</p> <p>Broad transfer zones with diffuse overland flows over often deflated surfaces. Slight vulnerability to erosion.</p>	<p>Mostly very sparse acacia shrublands commonly <i>Acacia tetragonophylla</i> and variously <i>Acacia incurvaneura</i>, <i>A. aptaneura</i>, <i>A. ramulosa</i> and <i>A. quadrimarginea</i> over very sparse lower shrubs including <i>Eremophila</i> spp., <i>Tuecrium teucriflorum</i> and <i>Ptilotus obovatus</i>.</p> <p>Plain acacia shrubland</p> <p>(PACS vegetation community)</p>

Land unit	Land form and soil type	Vegetation community
<p>4c. Plains supporting chenopod shrublands</p> 	<p>Gently inclined plains (slopes <math><1.5\%</math>) with mostly moderate to abundant mantles of quartz fragments.</p> <p>Mostly deep gradational, often calcareous, sandy clay loams or sandy clay loams gradational to light clay.</p> <p>Broad transfer zones with diffuse overland flows commonly over extensive deflated surfaces. Slightly to moderately vulnerable to erosion.</p>	<p>Very sparse to sparse, degraded chenopod shrublands dominated by <i>Maireana sedifolia</i> and <i>M. pyramidata</i> shrubland with very sparse overstorey of <i>Acacia incurvaneura</i>, <i>A. aptaneura</i> and <i>Casuarina pauper</i> with isolated <i>Pittosporum angustifolium</i>.</p> <p>“Plain mixed halophyte shrubland”(PXHS vegetation community) or “ Calcyphytic pearl bluebush shrubland”</p> <p>(CPBS vegetation community)</p>
<p>5a. Flood plains supporting chenopod shrublands.</p> 	<p>Near level to gently inclined (slopes <math><1.5\%</math>), flood plains (sometimes lumpy with low sandy rises) with sparse to moderate surface mantles of quartz fragments.</p> <p>Mostly shallow sandy loams or sandy clay loams often gradational to light clay and often over calcrete.</p> <p>Subject to sheet flow with more concentrated flow zones and extensive eroded, stripped surfaces. Moderate vulnerability to erosion.</p>	<p>Very sparse degraded chenopod shrublands dominated by <i>Maireana pyramidata</i> with a very sparse or isolated overstorey of <i>Acacia tetragonophylla</i>, <i>A. ceasaneura</i>, <i>A. burkittii</i> and <i>Hakea preissii</i>.</p> <p>“Hardpan plain acacia chenopod shrubland”</p> <p>(HCAS vegetation community).</p>

Land unit	Land form and soil type	Vegetation community
<p>6a. Drainage tracts.</p> 	<p>Drainage tracts from 25 to 120m wide with channels up to 3m wide by 1m deep and often several lesser channels.</p> <p>Mostly deep non-calcareous gradational sandy loams to sandy clay loams or sandy lay loams to light clay.</p> <p>Subject to sheet flow with extensive scalded surfaces. Moderate to high vulnerability to erosion.</p>	<p>Sparse to mid-dense acacia shrubland along drainage banks dominated by <i>Acacia burkittii</i> and <i>A. tetragonophylla</i> with taller <i>A. incurveaneura</i> and <i>Pttosporum angustifolium</i>. Sparse to mid-dense chenopod shrublands occur on islands and floodways dominated by <i>Maireana pyramidata</i> with <i>Atriplex bunburyana</i> and <i>Ptilotus obovatas</i></p> <p>“Drainage tract acacia shrubland with chenopod understorey” (DACS vegetation community).</p>

* (CPBS etc.) vegetation types see Table 3

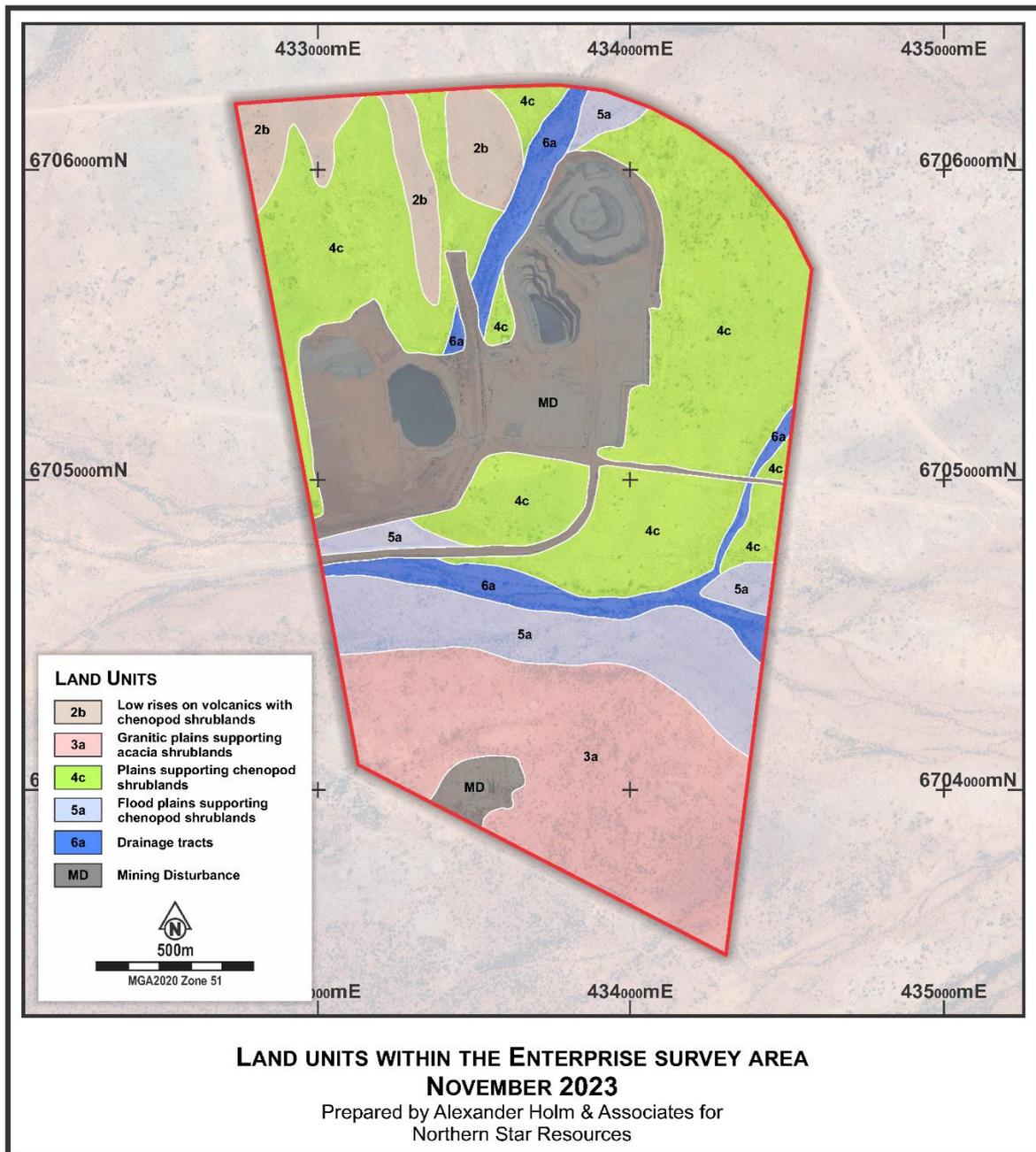


Figure 5: Land units within the Enterprise assessment area

5.3.2 Land unit areas

Low rises and gentle slopes with subdued exposed volcanics give way to gently sloping plains all supporting chenopod shrublands and together occupy 45% of the AE (Table 2). Flood plains supporting degraded chenopod shrublands with scattered acacias occupy 10% of the AE and the lower parts of the landscape intersected by incised drainage tracts. Shallow soil on slightly elevated granitic plains supporting patchy acacia shrublands occupy 20% and the remainder of the 367.6ha AE is mining disturbance (Table 2).

Table 2: Area of each land unit within the assessment area

Land unit	Description	Hectares	%
2b	Low rises on volcanics with chenopod shrublands	21.1	5.8
3a	Granitic plains supporting acacia shrublands	72.5	19.7
4c.	Plains supporting chenopod shrublands	128.0	34.8
5a.	Flood plains supporting chenopod shrublands	38.1	10.4
6a.	Drainage tracts	21.2	5.8
MD	Mining disturbance	86.6	23.6
Total		367.6	100.0

5.3.3 Vegetation communities

Most of the AE north of the southern drainage tract is occupied by low chenopod shrublands with calcyphytic pearl bluebush shrublands (CPBS) generally favouring slightly elevated landscapes while lower landscapes are occupied by plain mixed halophyte shrublands (PXHS). Acacia shrublands dominate granitic surfaces, drainage tracts and floodplains where chenopods are a sparse understory.

Table 3: Vegetation communities most commonly associated with land units.

Vegetation community	Description	Land unit
CPBS	Calcyphytic pearl bluebush shrublands (P)	2b 4c
PXHS	Plain mixed halophyte low shrublands (P)	4c
PACS	Plain acacia shrubland (new)	3a
HCAS	Hardpan plain acacia chenopod shrubland	5a
DRAS	Drainage tract acacia shrubland (new)	6a

*(P)(Pringle, Van Vreeswyk & Gilligan, 1994); (S) (Payne et al. 1998)

5.3.4 Vegetation and condition

The AE is within a pastoral lease and all areas have been heavily grazed. There is extensive mining infrastructure. The Yarrie road marks the northern boundary and the access road from Porphyry to the accommodation camp marks the southern boundary.

Vegetation structure and composition has been significantly altered throughout the entire AE and scalding is widespread. Alluvial flood plains, associated with drainage tracts (land unit 5a), supported vegetation attractive to livestock and are the most degraded (Table 4).

Table 4: Erosion status and vegetation condition ratings for each land unit

Land unit	Erosion status	Vegetation condition rating	Vegetation condition
2b Low rises on volcanics with chenopod shrublands	Stable	4	100% structure/ composition altered
3a Granitic plains supporting acacia shrublands	Mostly stable some scald	3-5	80% structure/ composition altered.
4c. Plains supporting chenopod shrublands	Mostly stable. Scalds common	3-4	20% structure mostly intact 80% structure/ composition altered
5a. Flood plains supporting chenopod shrublands	Mostly unstable Extensive scald	4-5	100% structure/ composition altered
6a Drainage tracts		3-5	40% structure mostly intact 60% structure/ composition altered

5.4. Threatened ecosystems and wetlands.

5.4.1 Threatened and priority ecological communities

There are no identified threatened ecological communities (TECs) in the MUR1 biogeographic subregion (Cowan, 2001).

There are no listed priority ecological communities (PECs) in the area.

5.4.2 Significant wetlands

There are no nationally significant wetlands in the area (Appendix 1).

5.4.3 Riparian vegetation

The AE landscape drains via overland flow into drainage tracts (land unit 6a) which support sparse to mid-dense acacia shrublands typical of the northern Goldfields.

5.5. Flora

5.5.1 General

Eighty nine flora taxa representing 23 families were found during the survey (Table 5). Chenopodiaceae accounted for 20 taxa, Fabaceae 16 taxa and Scrophulariaceae 9 taxa. There was one sterile specimen identified to genera level.

A list of species found at each inventory site is presented in Attachment 2. Species typifying the AE include: *Ptilotus obovatus* subsp. *obovatus*, *Maireana sedifolia*, *M. pyramidata*, *Acacia tetragonophylla* and *A. incurvaneura* all present on at least 70% of sites.

5.5.2 Declared weeds

Five weed species, *Citrullus amarus* (pie melon), *Cenchrus ciliaries* (Buffel grass), *Malvastrum americanum* (spiked malvastrum), *Salvia verbenaca* (wild sage) and *Sonchus oleraceus* (common sowthistle) were recorded during survey. All are classified s11 (permitted) as listed in the Western Australian Organism List (March 2021) under the Biosecurity and Management Act (2007).

5.5.3 Threatened and priority flora

No threatened (rare), endangered or priority flora taxa were found during survey.

Table 5: List of flora taxa found during field survey on each land unit in October 2023.

Family	Taxa	2b	3a	4c	5c	6a
Amaranthaceae	<i>Ptilotus obovatus</i> var. <i>obovatus</i>	y	y	y	y	y
Apocynaceae	<i>Marsdenia australis</i>		y	y		
Asteraceae	<i>Asteridea athrixioides</i>		y			
Asteraceae	<i>Brachyscome perpusilla</i>		y	y	y	
Asteraceae	<i>Cratystylis subspinescens</i>			y		
Asteraceae	<i>Sonchus oleraceus</i>			y	y	y
Asteraceae	<i>Vittadinia sulcata</i>		y	y	y	y
Casuarinaceae	<i>Casuarina pauper</i>			y		
Chenopodiaceae	<i>Atriplex acutibractea</i> subsp. <i>acutibractea</i>			y		y
Chenopodiaceae	<i>Atriplex bunburyana</i>			y	y	y
Chenopodiaceae	<i>Atriplex codonocarpa</i>			y		
Chenopodiaceae	<i>Chenopodium gaudichaudianum</i>			y		y
Chenopodiaceae	<i>Enchylaena lanata</i>					y
Chenopodiaceae	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>		y	y	y	y
Chenopodiaceae	<i>Maireana georgei</i>		y	y	y	y
Chenopodiaceae	<i>Maireana integra</i>	y	y	y	y	y
Chenopodiaceae	<i>Maireana pyramidata</i>		y	y	y	y
Chenopodiaceae	<i>Maireana sedifolia</i>	y	y	y	y	y
Chenopodiaceae	<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	y	y	y	y	
Chenopodiaceae	<i>Maireana triptera</i>		y	y	y	y
Chenopodiaceae	<i>Rhagodia eremaea</i>		y	y	y	
Chenopodiaceae	<i>Salsola australis</i>	y	y	y	y	y
Chenopodiaceae	<i>Sclerolaena cuneata</i>		y	y	y	
Chenopodiaceae	<i>Sclerolaena densiflora</i>					y
Chenopodiaceae	<i>Sclerolaena diacantha</i>			y	y	y
Chenopodiaceae	<i>Sclerolaena eurotioides</i>		y	y	y	y
Chenopodiaceae	<i>Sclerolaena gardneri</i>	y		y	y	y
Chenopodiaceae	<i>Sclerolaena fusiformis</i>		y	y	y	y
Convolvulaceae	<i>Convolvulus recurvatus</i> subsp. <i>nullarborensis</i>		y	y	y	y
Convolvulaceae	<i>Duperreya commixta</i>		y		y	y

Family	Taxa	2b	3a	4c	5c	6a
Crassulaceae	<i>Crassula colorata</i> var. <i>colorata</i>		y			
Cucurbitaceae	<i>Citrullus amarus</i>			y		
Fabaceae	<i>Acacia aneura</i>			y		
Fabaceae	<i>Acacia aptaneura</i>		y	y		
Fabaceae	<i>Acacia burkittii</i>	y	y	y	y	y
Fabaceae	<i>Acacia ceasaneura</i>		y	y	y	
Fabaceae	<i>Acacia craspedocarpa</i>				y	
Fabaceae	<i>Acacia incurvaneura</i>		y	y	y	y
Fabaceae	<i>Acacia ligulata</i>					y
Fabaceae	<i>Acacia quadrimarginea</i>		y	y	y	
Fabaceae	<i>Acacia ramulosa</i> var. <i>ramulosa</i>		y			
Fabaceae	<i>Acacia tetragonophylla</i>	y	y	y	y	y
Fabaceae	<i>Acacia ayersiana</i>		y			
Fabaceae	<i>Senna artemisioides</i> subsp. <i>xartemisioides</i>		y		y	
Fabaceae	<i>Senna artemisioides</i> subsp. <i>filifolia</i>	y	y	y	y	y
Fabaceae	<i>Senna cardiosperma</i>		y	y	y	
Fabaceae	<i>Senna artemisioides</i> subsp. <i>xpetiolaris</i>				y	
Fabaceae	<i>Senna artemisioides</i> subsp. <i>xsturtii</i>				y	
Frankeniaceae	<i>Frankenia interioris</i>			y		
Goodeniaceae	<i>Scaevola spinescens</i>		y	y		y
Lamiaceae	<i>Salvia verbenaca</i>			y	y	y
Lamiaceae	<i>Teucrium teucriiflorum</i>		y			
Loranthaceae	<i>Lysiana murrayi</i>		y	y		
Malvaceae	<i>Abutilon cryptopetalum</i>					y
Malvaceae	<i>Abutilon otocarpum</i>		y			y
Malvaceae	<i>Brachychiton gregorii</i>		y			
Malvaceae	<i>Malvastrum americanum</i>			y	y	y
Malvaceae	<i>Sida calyxhymenia</i>			y		
Malvaceae	<i>Sida intricata</i>		y	y	y	y
Malvaceae	<i>Sida spodochroma</i>	y	y	y	y	y

Family	Taxa	2b	3a	4c	5c	6a
Malvaceae	<i>Sida calyxhymenia</i>		y		y	y
Pittosporaceae	<i>Pittosporum angustifolium</i>			y		y
Poaceae	<i>Aristida contorta</i>		y	y	y	
Poaceae	<i>Austrostipa scabra</i>		y	y	y	y
Poaceae	<i>Cenchrus ciliaries</i>					y
Poaceae	<i>Enneapogon cylindricus</i>		y	y	y	
Poaceae	<i>Enteropogon ramosus</i>				y	y
Poaceae	<i>Paspelidium gracile</i>			y		y
Poaceae	<i>Rytidosperma robertsoniae</i>		y	y	y	
Proteaceae	<i>Hakea preissii</i>			y	y	y
Pteridaceae	<i>Cheilanthes sieberi</i>		y			
Santalaceae	<i>Santalum spicatum</i>			y		y
Santalaceae	<i>Santalum murrayanum</i>		y			
Sapindaceae	<i>Dodonaea lobulata</i>		y	y	y	y
Sapindaceae	<i>Dodonaea viscosa</i>		y			
Scrophulariaceae	<i>Eremophila alternifolia</i>				y	y
Scrophulariaceae	<i>Eremophila granitica</i>		y			
Scrophulariaceae	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>		y			
Scrophulariaceae	<i>Eremophila metallicorum</i>		y		y	
Scrophulariaceae	<i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i>		y			y
Scrophulariaceae	<i>Eremophila scoparia</i>			y	y	y
Scrophulariaceae	<i>Eremophila serrulata</i>		y			
Scrophulariaceae	<i>Eremophila</i> sp.		y		y	
Scrophulariaceae	<i>Eremophila longifolia</i>		y	y	y	y
Solanaceae	<i>Nicotiana rotundifolia</i>					y
Solanaceae	<i>Solanum hoplopetalum</i>		y	y	y	y
Solanaceae	<i>Solanum lasiophyllum</i>	y	y	y	y	y
Zygophyllaceae	<i>Roepera eremaea</i>					Y
Zygophyllaceae	<i>Roepera ovata</i>		y	y		y

5.6. Fauna

5.6.1 General

Twelve bird and one reptile (gecko) were noted during field survey (Table 6).

5.6.2 Conservation significant fauna

No conservation significant fauna were identified during field survey.

Table 6 List of fauna found during survey in October 2023

Taxa	Common name
Birds	
<i>Acanthiza apicalis</i>	Inland Thornbill
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill
<i>Accipiter fasciatus</i>	Brown Goshawk
<i>Corvus coronoides</i>	Australian Raven
<i>Gavicalis virescens</i>	Singing Honeyeater
<i>Hirundo neoxena</i>	Welcome Swallow
<i>Malurus leucopterus</i>	White-winged Fairy-wren
<i>Malurus splendens</i>	Splendid Fairy-wren
<i>Melanodryas cucullata</i>	Hooded Robin
<i>Oreoica gutturalis</i>	Crested Bellbird
<i>Pachycephala rufiventris</i>	Rufous Whistler
<i>Petrochelidon nigricans</i>	Tree Martin
Reptiles	
<i>Gehyra variegata</i>	Variegated dtella (gecko)

6. Discussion

Landscape within the AE is widely and noticeably degraded. Effects of historical stock grazing are evident throughout the AE with greatest impact on alluvial flood plains, associated with drainage tracts, where soil erosion and vegetation composition change are most evident.

While flora composition and vegetation associations within the AE are degraded, they are typical of the region and not considered unusually diverse. There are no Threatened Ecological Communities (TECs) and no Priority Ecological Communities within or adjacent to the survey area.

No listed species of rare or critically endangered flora were found during this survey and there are no records of Declared Rare Flora (DRF) found in or nearby the survey area.

Thryptomene eremaea (P2), was considered likely to occur on granitic surfaces of land unit 3a. No plants were found during on foot searches, and it is unlikely that *T. eremaea* occurs in the AE.

Eremophila arachnoides subsp. *tenera* (P3) was considered likely to occur on saline alluvial plains of land unit 5c. No plants were found during on foot searches, and it is considered unlikely that EAT occurs elsewhere within this unit.

Acacia eremophila var. numerous-nerved variant, was not found in the AE.

Five weed species were recorded during survey. All are classified s11 (permitted) as listed in the Western Australian Organism List (March 2021) under the Biosecurity and Management Act (2007).

No conservation fauna were found in the AE.

7. References

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Disclaimer

Within the limitation imposed by the scope of review, the data assessment and preparation of the report have been undertaken in a professional manner and in accordance with generally accepted practices using a degree of care ordinarily exercised by professional environmental consultants. No other warranty, expressed or implied, is made.

8. Attachments

Attachment 1: 'Protected matters' search tool output

Attachment 2: List of flora taxa found at each inventory site

Family	Taxa	01	02	03	04	05	06	07	08	09	10	11
Amaranthaceae	<i>Ptilotus obovatus</i> var. <i>obovatus</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Apocynaceae	<i>Marsdenia australis</i>	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y
Asteraceae	<i>Asteridea athrixoides</i>	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y
Asteraceae	<i>Brachyscome perpusilla</i>	Y	Y		Y	Y	Y	Y	Y			Y
Asteraceae	<i>Cratystylis subspinescens</i>		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Asteraceae	<i>Sonchus oleraceus</i>		Y	Y	Y	Y		Y	Y		Y	Y
Asteraceae	<i>Vittadinia sulcata</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Casuarinaceae	<i>Casuarina pauper</i>	Y	Y	Y	Y	Y	Y		Y			
Chenopodiaceae	<i>Atriplex acutibractea</i> subsp. <i>acutibractea</i>	Y	Y	Y			Y	Y	Y	Y	Y	Y
Chenopodiaceae	<i>Atriplex bunburyana</i>				Y	Y	Y		Y	Y		
Chenopodiaceae	<i>Atriplex codonocarpa</i>				Y	Y	Y		Y	Y	Y	Y
Chenopodiaceae	<i>Chenopodium gaudichaudianum</i>	Y			Y		Y		Y	Y	Y	Y
Chenopodiaceae	<i>Enchylaena lanata</i>		Y	Y	Y		Y	Y	Y	Y	Y	Y
Chenopodiaceae	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>		Y	Y			Y		Y			Y
Chenopodiaceae	<i>Maireana georgei</i>	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Chenopodiaceae	<i>Maireana integra</i>	Y	Y	Y	Y		Y	Y		Y	Y	
Chenopodiaceae	<i>Maireana pyramidata</i>		Y		Y			Y			Y	Y
Chenopodiaceae	<i>Maireana sedifolia</i>				Y		Y	Y	Y			
Chenopodiaceae	<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>					Y			Y			
Chenopodiaceae	<i>Maireana triptera</i>		Y	Y	Y		Y		Y	Y	Y	Y
Chenopodiaceae	<i>Rhagodia eremaea</i>				Y		Y		Y		Y	Y
Chenopodiaceae	<i>Salsola australis</i>				Y		Y		Y		Y	Y
Chenopodiaceae	<i>Sclerolaena cuneata</i>					Y		Y	Y	Y	Y	Y
Chenopodiaceae	<i>Sclerolaena densiflora</i>					Y	Y		Y	Y		Y
Chenopodiaceae	<i>Sclerolaena diacantha</i>			Y	Y	Y	Y	Y	Y		Y	
Chenopodiaceae	<i>Sclerolaena eurotioides</i>	Y		Y			Y		Y	Y		Y
Chenopodiaceae	<i>Sclerolaena gardneri</i>					Y			Y			
Chenopodiaceae	<i>Sclerolaena fusiformis</i>						Y	Y	Y		Y	
Convolvulaceae	<i>Convolvulus recurvatus</i> subsp. <i>nullarborensis</i>				Y						Y	
Convolvulaceae	<i>Duperreya commixta</i>			Y			Y	Y	Y		Y	Y

Family	Taxa	01	02	03	04	05	06	07	08	09	10	11
Crassulaceae	<i>Crassula colorata</i> var. <i>colorata</i>				Y				Y			
Cucurbitaceae	<i>Citrullus amarus</i>			Y						Y		Y
Fabaceae	<i>Acacia aneura</i>			Y	Y	Y			Y			
Fabaceae	<i>Acacia aptaneura</i>		Y				Y		Y			Y
Fabaceae	<i>Acacia burkittii</i>					Y		Y			Y	
Fabaceae	<i>Acacia ceasaneura</i>						Y					
Fabaceae	<i>Acacia craspedocarpa</i>							Y				
Fabaceae	<i>Acacia incurvaneura</i>		Y	Y		Y						
Fabaceae	<i>Acacia ligulata</i>							Y				Y
Fabaceae	<i>Acacia quadrimarginea</i>											
Fabaceae	<i>Acacia ramulosa</i> var. <i>ramulosa</i>						Y					
Fabaceae	<i>Acacia tetragonophylla</i>										Y	
Fabaceae	<i>Acacia ayersiana</i>					Y	Y	Y	Y			
Fabaceae	<i>Senna artemisioides</i> subsp. <i>xartemisioides</i>			Y		Y		Y				Y
Fabaceae	<i>Senna artemisioides</i> subsp. <i>filifolia</i>											
Fabaceae	<i>Senna cardiosperma</i>		Y		Y						Y	
Fabaceae	<i>Senna artemisioides</i> subsp. <i>xpetiolaris</i>											
Fabaceae	<i>Senna artemisioides</i> subsp. <i>xsturtii</i>											
Frankeniaceae	<i>Frankenia interioris</i>											
Goodeniaceae	<i>Scaevola spinescens</i>											
Lamiaceae	<i>Salvia verbenaca</i>											
Lamiaceae	<i>Teucrium teucriiflorum</i>				Y							Y
Loranthaceae	<i>Lysiana murrayi</i>							Y	Y			
Malvaceae	<i>Abutilon cryptopetalum</i>						Y					
Malvaceae	<i>Abutilon otocarpum</i>											
Malvaceae	<i>Brachychiton gregorii</i>				Y							
Malvaceae	<i>Malvastrum americanum</i>											
Malvaceae	<i>Sida calyxhymenia</i>											
Malvaceae	<i>Sida intricata</i>											
Malvaceae	<i>Sida spodochroma</i>						Y					

Family	Taxa	01	02	03	04	05	06	07	08	09	10	11
Malvaceae	<i>Sida calyxhymenia</i>											
Pittosporaceae	<i>Pittosporum angustifolium</i>		Y				Y					
Poaceae	<i>Aristida contorta</i>							Y				
Poaceae	<i>Austrostipa scabra</i>						Y	Y				
Poaceae	<i>Cenchrus ciliaries</i>								Y			
Poaceae	<i>Enneapogon cylindricus</i>											
Poaceae	<i>Enteropogon ramosus</i>				Y	Y						
Poaceae	<i>Paspelidium gracile</i>											
Poaceae	<i>Rytidosperma robertsoniae</i>											
Proteaceae	<i>Hakea preissii</i>											
Pteridaceae	<i>Cheilanthes sieberi</i>						Y					
Santalaceae	<i>Santalum spicatum</i>						Y					
Santalaceae	<i>Santalum murrayanum</i>				Y							
Sapindaceae	<i>Dodonaea lobulata</i>				Y							
Sapindaceae	<i>Dodonaea viscosa</i>											
Scrophulariaceae	<i>Eremophila alternifolia</i>							Y				
Scrophulariaceae	<i>Eremophila granitica</i>											
Scrophulariaceae	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>											
Scrophulariaceae	<i>Eremophila metallicorum</i>											
Scrophulariaceae	<i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i>											
Scrophulariaceae	<i>Eremophila scoparia</i>											
Scrophulariaceae	<i>Eremophila serrulata</i>						Y					
Scrophulariaceae	<i>Eremophila</i> sp.				Y							
Scrophulariaceae	<i>Eremophila longifolia</i>		Y									
Solanaceae	<i>Nicotiana rotundifolia</i>				Y							
Solanaceae	<i>Solanum hoplopetalum</i>											
Solanaceae	<i>Solanum lasiophyllum</i>											
Zygophyllaceae	<i>Roepera eremaea</i>				Y							
Zygophyllaceae	<i>Roepera ovata</i>				Y							Y

Family	Taxa	12	13	14	15	16	17	18	19	20	21
Amaranthaceae	<i>Ptilotus obovatus</i> var. <i>obovatus</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Apocynaceae	<i>Marsdenia australis</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Asteraceae	<i>Asteridea athrixoides</i>		Y	Y	Y	Y	Y	Y	Y	Y	
Asteraceae	<i>Brachyscome perpusilla</i>	Y	Y	Y		Y	Y	Y	Y	Y	Y
Asteraceae	<i>Cratystylis subspinescens</i>	Y			Y	Y		Y	Y	Y	
Asteraceae	<i>Sonchus oleraceus</i>	Y	Y	Y	Y	Y			Y	Y	Y
Asteraceae	<i>Vittadinia sulcata</i>	Y					Y	Y	Y		
Casuarinaceae	<i>Casuarina pauper</i>	Y	Y	Y	Y	Y	Y	Y	Y		
Chenopodiaceae	<i>Atriplex acutibractea</i> subsp. <i>acutibractea</i>					Y	Y	Y	Y		
Chenopodiaceae	<i>Atriplex bunburyana</i>	Y		Y	Y	Y	Y		Y	Y	
Chenopodiaceae	<i>Atriplex codonocarpa</i>	Y			Y	Y		Y	Y		
Chenopodiaceae	<i>Chenopodium gaudichaudianum</i>		Y		Y		Y	Y	Y		
Chenopodiaceae	<i>Enchylaena lanata</i>				Y			Y	Y		
Chenopodiaceae	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Y	Y		Y	Y		Y	Y		Y
Chenopodiaceae	<i>Maireana georgei</i>							Y			
Chenopodiaceae	<i>Maireana integra</i>				Y		Y			Y	
Chenopodiaceae	<i>Maireana pyramidata</i>		Y		Y		Y	Y	Y	Y	
Chenopodiaceae	<i>Maireana sedifolia</i>		Y		Y	Y	Y		Y	Y	Y
Chenopodiaceae	<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	Y	Y		Y	Y	Y	Y	Y	Y	
Chenopodiaceae	<i>Maireana triptera</i>					Y		Y			
Chenopodiaceae	<i>Rhagodia eremaea</i>				Y	Y		Y	Y		
Chenopodiaceae	<i>Salsola australis</i>		Y	Y			Y	Y			
Chenopodiaceae	<i>Sclerolaena cuneata</i>				Y	Y	Y				
Chenopodiaceae	<i>Sclerolaena densiflora</i>	Y		Y						Y	Y
Chenopodiaceae	<i>Sclerolaena diacantha</i>						Y	Y			
Chenopodiaceae	<i>Sclerolaena eurotioides</i>	Y						Y			
Chenopodiaceae	<i>Sclerolaena gardneri</i>	Y	Y	Y	Y					Y	Y
Chenopodiaceae	<i>Sclerolaena fusiformis</i>	Y	Y				Y	Y			
Convolvulaceae	<i>Convolvulus recurvatus</i> subsp. <i>nullarborensis</i>	Y	Y			Y	Y			Y	Y
Convolvulaceae	<i>Duperreya commixta</i>				Y					Y	

Family	Taxa	12	13	14	15	16	17	18	19	20	21
Crassulaceae	<i>Crassula colorata</i> var. <i>colorata</i>	Y				Y	Y	Y	Y	Y	
Cucurbitaceae	<i>Citrullus amarus</i>				Y	Y		Y	Y		
Fabaceae	<i>Acacia aneura</i>				Y			Y	Y		
Fabaceae	<i>Acacia aptaneura</i>	Y			Y		Y				
Fabaceae	<i>Acacia burkittii</i>				Y	Y		Y	Y		
Fabaceae	<i>Acacia ceasaneura</i>	Y	Y		Y	Y			Y		
Fabaceae	<i>Acacia craspedocarpa</i>	Y	Y		Y		Y				Y
Fabaceae	<i>Acacia incurvaneura</i>				Y		Y		Y		
Fabaceae	<i>Acacia ligulata</i>			Y	Y	Y					
Fabaceae	<i>Acacia quadrimarginea</i>			Y		Y	Y	Y	Y		
Fabaceae	<i>Acacia ramulosa</i> var. <i>ramulosa</i>							Y	Y	Y	Y
Fabaceae	<i>Acacia tetragonophylla</i>				Y		Y	Y	Y		
Fabaceae	<i>Acacia ayersiana</i>								Y		
Fabaceae	<i>Senna artemisioides</i> subsp. <i>xartemisioides</i>					Y					
Fabaceae	<i>Senna artemisioides</i> subsp. <i>filifolia</i>	Y	Y				Y		Y		Y
Fabaceae	<i>Senna cardiosperma</i>					Y					
Fabaceae	<i>Senna artemisioides</i> subsp. <i>xpetiolaris</i>			Y			Y			Y	Y
Fabaceae	<i>Senna artemisioides</i> subsp. <i>xsturtii</i>						Y	Y	Y	Y	
Frankeniaceae	<i>Frankenia interioris</i>		Y				Y			Y	Y
Goodeniaceae	<i>Scaevola spinescens</i>		Y				Y			Y	Y
Lamiaceae	<i>Salvia verbenaca</i>		Y				Y	Y		Y	
Lamiaceae	<i>Teucrium teucriiflorum</i>	Y					Y				
Loranthaceae	<i>Lysiana murrayi</i>									Y	
Malvaceae	<i>Abutilon cryptopetalum</i>				Y		Y				
Malvaceae	<i>Abutilon otocarpum</i>		Y			Y	Y				
Malvaceae	<i>Brachychiton gregorii</i>								Y		Y
Malvaceae	<i>Malvastrum americanum</i>				Y	Y			Y		
Malvaceae	<i>Sida calyxhymenia</i>					Y		Y	Y		
Malvaceae	<i>Sida intricata</i>	Y				Y	Y				
Malvaceae	<i>Sida spodochroma</i>					Y		Y			

Family	Taxa	12	13	14	15	16	17	18	19	20	21
Malvaceae	<i>Sida calyxhymenia</i>									Y	Y
Pittosporaceae	<i>Pittosporum angustifolium</i>										
Poaceae	<i>Aristida contorta</i>					Y					
Poaceae	<i>Austrostipa scabra</i>										
Poaceae	<i>Cenchrus ciliaries</i>						Y				
Poaceae	<i>Enneapogon cylindricus</i>									Y	Y
Poaceae	<i>Enteropogon ramosus</i>										
Poaceae	<i>Paspelidium gracile</i>									Y	Y
Poaceae	<i>Rytidosperma robertsoniae</i>									Y	Y
Proteaceae	<i>Hakea preissii</i>									Y	Y
Pteridaceae	<i>Cheilanthes sieberi</i>										
Santalaceae	<i>Santalum spicatum</i>										
Santalaceae	<i>Santalum murrayanum</i>										
Sapindaceae	<i>Dodonaea lobulata</i>										
Sapindaceae	<i>Dodonaea viscosa</i>			Y							
Scrophulariaceae	<i>Eremophila alternifolia</i>										
Scrophulariaceae	<i>Eremophila granitica</i>								Y		
Scrophulariaceae	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>					Y					
Scrophulariaceae	<i>Eremophila metallicorum</i>			Y							
Scrophulariaceae	<i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i>								Y		
Scrophulariaceae	<i>Eremophila scoparia</i>								Y		
Scrophulariaceae	<i>Eremophila serrulata</i>										
Scrophulariaceae	<i>Eremophila</i> sp.										
Scrophulariaceae	<i>Eremophila longifolia</i>										
Solanaceae	<i>Nicotiana rotundifolia</i>										
Solanaceae	<i>Solanum hoplopetalum</i>			Y							
Solanaceae	<i>Solanum lasiophyllum</i>		Y								
Zygophyllaceae	<i>Roepera eremaea</i>										
Zygophyllaceae	<i>Roepera ovata</i>	Y					Y				

Attachment 3: Inventory site data on geomorphology soil and erosion.

Site	Lu	Geol	Slope (%)	Relief (m)	Land form	Soil type (A) (B)		Erosion	Geomorphology description	Soil description
EN01	2b	AIV	2.5	10	Upper slope	Sl*	scl	Stable	Gently inclined plain raising to 10m. Mostly diffuse overland flow with minor flow zones. Extensive deflated surfaces	Deep calcareous gradational
EN14	3a	Agop	1		Drainage tract	lc		Stable	50m wide non-incised drainage tract with intact surfaces	Deep non-calcareous light clay
EN20	3a	Agop	<1		Flat	scl		Mostly stable	Extensive near level plain with deflated surfaces and abundant quartz mantle and diffuse overland flow	Shallow non-calcareous sandy clay loam over ferruginous hardpan
EN21	3a	Agop	1.5		Mid slope	scl		Mostly stable	Gently inclined plain below slight rise with abundant ironstone fine gravel. Deflated surfaces and diffuse overland flow. Minor quartz outcrops	Deep non-calcareous sandy clay loam
EN12	3a	Agop	<1		Flat	scl		80% stable	Near level plain with extensive water stripped surfaces and sheet flows	Variable depth shallow non-calcareous sandy clay loam
EN13	3a	Agop	<1		Flat	scl	lc	80% stable	Near level plain with diffuse overland flow and 80% deflated quartz-strewn surfaces	Variable depth shallow non-calcareous gradational over calcrete
EN17	3a	Qa	1		Flat	scl		Mostly stable	Gently sloping quartz strewn plain with diffuse overland flow and deflated surfaces	Deep non-calcareous sandy clay loam
EN02	4c	AIV	1.5	8	Mid slope	scl		70% stable	Gently inclined plain with occasional quartz outcrops and diffuse overland flow with minor incised erosion faces	Deep calcareous sandy clay loam
EN03	4c	AIV	1.5	8	Lower slope	sl	scl	70% stable	Gently inclined plain mostly diffuse overland flow. 50% deflated surfaces with minor incised erosion faces	Shallow calcareous gradational over shale
EN07	4c	Czc	1.5		Flat	scl		Mostly stable	Gently inclined plain with mostly diffuse overland flow and 80% deflated quartz strewn surfaces	Deep calcareous sandy clay loam
EN09	4c	Czc	<1		Flat	scl		Stable	Near level plain with diffuse overland flow with mostly intact surfaces and minor water deflated surfaces	Deep calcareous sandy clay loam
EN10	4c	Czc	1.5		Flat	scl		70% stable	Gently inclined plain with mostly diffuse overland flow and intact surfaces with minor water deflated surfaces	Deep calcareous sandy clay loam
EN11	4c	Qa	1		Flat	scl	lc	Mostly stable	Broad flow zone within a near level plain with extensive water deflated surfaces and quartz patches	Deep calcareous gradational
EN05	4c	Qa	1.5		Flat	scl	lc	Mostly stable	Flood plain with extensive water deflated surfaces and concentrated flow zones	Deep non-calcareous gradational
EN06	4c	Czc	1.5		Flat	lc		Mostly stable	Gently inclined plain with extensive water deflated quartz strewn surfaces within a broad concentrated flow zone	Deep non-calcareous light clay

Site	Lu	Geol	Slope (%)	Relief (m)	Land form	Soil type (A) (B)		Erosion	Geomorphology description	Soil description
EN08	4c	Czc	1.5		Flat	scl	lc	Mostly stable	Broad flow zone within a gently inclined plain with mostly diffuse overland flow and 90% deflated surfaces	Deep non-calcareous gradational
EN18	5a	Qa	>1		Flat	scl		Stable	Near level plain with diffuse overland flows and 100% deflated surfaces with bare quartz strewn patches	Shallow non-calcareous sandy clay loam over calcrete
EN19	5a	Qa	1		Flat	sl	scl	Mostly unstable	Gently inclined eroded flood plain with low sandy rises and deflated surfaces with concentrated flow zones	Shallow gradational over calcrete
EN15	5a	Qa	1.5		Lower slope	sl	lc	Mostly stable	Gently inclined plain with lumpy basalt rises, 100% windswept deflated surfaces with areas of concentrated flow	Deep non-calcareous duplex
EN16	6a	Qa	1.5		Drainage tract	sl	scl	Mostly unstable	Braided drainage tract with main channel 3m wide by 1m deep and several lesser channels	Deep non-calcareous gradational
EN04	6a	Qa	1.5		minor creek	scl	lc	Mostly unstable	Drainage tract with several channels up to 2m wide by 1m deep.	Deep non-calcareous gradational

*SL: sandy loam

SCL: sandy clay loam

LC: light clay

Attachment 4: Inventory site data on vegetation type condition and dominant species and cover in each stratum

Site	Lu	Veg. type	Upper storey dominant		Mid storey dominant		Lower storey dominant		Total cover	Veg cond.	Vegetation description
			%C		%C		%C		TC%		
EN01	2b	CPBS			acabur	1	maised	15	16	4	Sparse degraded chenopod shrubland with isolated taller shrubs
EN12	3a	PACS	acaapt	1	acetet	5	ptiobo	1	7	5	Severely degraded very sparse acacia shrubland with isolated mulga
EN13	3a	PACS	acaqua	8	acetet	2	scvspi	2	12	4	Very sparse acacia shrubland with very sparse degraded understorey
EN14	3a	DRAS	acainc	5	acainc	30	ptiobo	<1	35	3	Mid-dense acacia shrubland
EN17	3a	PACS	acainc	1	acaram	4	eresp	2	7	4	Very sparse acacia eremophila shrubland with very sparse degraded chenopod understorey
EN20	3a	PACS	acainc	1	acaram	10	tuetue	1	12	4	Very sparse patchy acacia shrubland with very sparse understorey
EN21	3a	PACS	acainc	4	acaram	6	tuetue	<1	10	4	Very sparse acacia shrubland over near-totally degraded understorey
EN02	4c	CPBS	caspau	1	acabur	<1	maised	15	16	4	Sparse degraded chenopod shrubland with isolated caspau mulga
EN03	4c	CPBS	acainc	2			maised	20	22	4	Sparse degraded chenopod shrubland with very sparse mulga and isolated stunted caspau
EN05	4c	PXHS	acaapt	1	acetet	1	maipyr	10	12	4	Very sparse degraded chenopod shrubland with isolated mulga
EN06	4c	PXHS	acaapt	2	acetet	<1	maipyr	20	22	3	Sparse chenopod shrubland with very sparse mulga overstorey
EN07	4c	CPBS	acainc	1	acetet	<1	maised	15	16	4	Sparse degraded chenopod shrubland with isolated caspau mulga
EN08	4c	PXHS	acainc	4	acetet	<1	maipyr	20	24	3	Sparse chenopod shrubland with very sparse mulga overstorey
EN09	4c	CPBS	caspau	<1			maised	20	20	4	Sparse degraded chenopod shrubland with isolated caspau
EN10	4c	CPBS	acainc	2	snfil	<1	maised	20	22	4	Sparse degraded chenopod shrubland with patchy very sparse mulga overstorey
EN11	4c	CPBS	acainc	1	acabur	1	maipyr	10	12	4	Very sparse degraded chenopod shrubland with isolated mulga
EN15	5a	PXHS	acaqua	<1	acetet	<1	maipyr	15	15	4	Very sparse degraded chenopod shrubland (many dead) with isolated acacia
EN18	5a	HCAS	acacae	1	acetet	1	maipyr	10	12	4	Very sparse degraded chenopod shrubland with isolated acacia
EN19	5a	HCAS	acacae	1	acetet	2	maipyr	5	8	5	Very sparse degraded chenopod shrubland with very sparse acacia overstorey

Site	Lu	Veg. type	Upper storey dominant	%C	Mid storey dominant	%C	Lower storey dominant	%C	Total cover	Veg cond.	Vegetation description
EN04	6a	DRAS	acainc	2	acabur	15	maipyr	5	22	3	Sparse acacia shrubland along creek channels with isolated pitang with very sparse chenopod shrubland on mini islands
EN16	6a	DACS	acainc	1	acabur	14	maipyr	25	40	3	Mid-dense acacia shrubland along creek banks with sparse to mid-dense chenopod shrublands on islands and floodways

Field code	Taxa
acabur	<i>Acacia burkittii</i>
acaapt	<i>Acacia aptaneura</i>
acacae	<i>Acacia caesaneura</i>
acainc	<i>Acacia incurvaneura</i>
acaqua	<i>Acacia quadrimarginea</i>
acaram	<i>Acacia ramulosa</i> var. <i>linophylla</i>
acatet	<i>Acacia tetragonophylla</i>
caspau	<i>Casuarina pauper</i>
maipyr	<i>Maireana pyramidata</i>
maised	<i>Maireana sedifolia</i>
ptiobo	<i>Ptilotus obovatus</i>
scvspi	<i>Scaevola spinescens</i>
snfil	<i>Senna artemisioides</i> subsp. <i>filifolia</i>
tuetue	<i>Teucrium teucriiflorum</i>

Attachment 5: Location of inventory sites

Site	Zone	Easting	Northing
EN01	UTM	51J	433489 6706095
EN02	UTM	51J	433188 6705990
EN03	UTM	51J	432955 6705851
EN04	UTM	51J	433540 6705715
EN05	UTM	51J	433872 6706177
EN06	UTM	51J	434150 6706016
EN07	UTM	51J	434323 6705590
EN08	UTM	51J	434261 6705819
EN09	UTM	51J	434072 6704904
EN10	UTM	51J	434212 6705085
EN11	UTM	51J	434356 6704608
EN12	UTM	51J	434247 6704089
EN13	UTM	51J	433999 6704251
EN14	UTM	51J	433892 6704367
EN15	UTM	51J	434164 6704488
EN16	UTM	51J	434187 6704601
EN17	UTM	51J	433575 6704316
EN18	UTM	51J	433510 6704561
EN19	UTM	51J	433119 6704624
EN20	UTM	51J	433893 6703950
EN21	UTM	51J	434148 6703763
