

Conservation Values of remnant flora and vegetation within current mining areas at Harmony Gold, Mt Magnet

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Summary of findings against the Clearing Principles (*Environmental Protection Act 1986*)

The findings of the survey work have been assessed against the clearing principles a, c, d and h.

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

Taking into account representativeness of the area within the Bioregion, ecosystem diversity, diversity of plant species at the bioregional and local level, and acknowledging that this report does not consider the fauna values in addressing this Principle, it is not considered that the proposed clearing comprises a high level of biological diversity. In addition the vegetation surveyed is mostly in a highly degraded state unlikely to be able to be restored and consequently considered of with low conservation value.

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

No flora that are known as Declared Rare Flora under the *Wildlife Conservation Act 1950* are known from the area or recorded during the survey. Scattered individuals of the Priority Three taxon, *Acacia speckii*, were recorded at three locations. *Acacia speckii* is known from populations ranging from 100 km north of Meekatharra to Yalgoo (Florabase 2006). This species was recorded from seven different locations within MMG tenements during the October 2006 surveys.

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

There are no known Threatened Ecological Communities recorded from the proposed clearing area. All the vegetation types recorded are considered to be widespread throughout the Bioregion

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

The proposed clearing is an area surrounded by existing mine operations and associated infrastructure and exhibits high levels of disturbance. There is no nearby or adjacent conservation area.

1.0 Introduction

Harmony Gold Australia, Mt Magnet operates open cut and underground mining just outside the town of Mt Magnet. A series of low lying, narrow ridges comprised of Banded Ironstone Formations (BIFs) occur throughout the MMG tenements. Within the broad footprint of current mine operations, many of these have been subjected to historical and more recent disturbance. A number of these sites are proposed for development of new pits and waste dumps.

Western Botanical was commissioned by Harmony Gold Australia, Mt Magnet (MMG) to undertake a flora and vegetation survey of several areas across MMG tenements. The survey areas comprised proposed pits waste dumps and exploration tenements. The findings of the survey were being presented in a series of five reports, three of these for specific areas (Eclipse, Golden Stream and Hesperus) have been previously reported (Kern & True 2006a, 2006b, 2006c).

Within the main area of existing mines and mining activity some areas of vegetation occur as remnants associated primarily with the banded ironstone formations. This report documents the surveys of the remnants within this vicinity, bounded by the approximate area extending from the Mars pit in the north to the Valhalla pit in the south (the survey area).

2.0 Methods

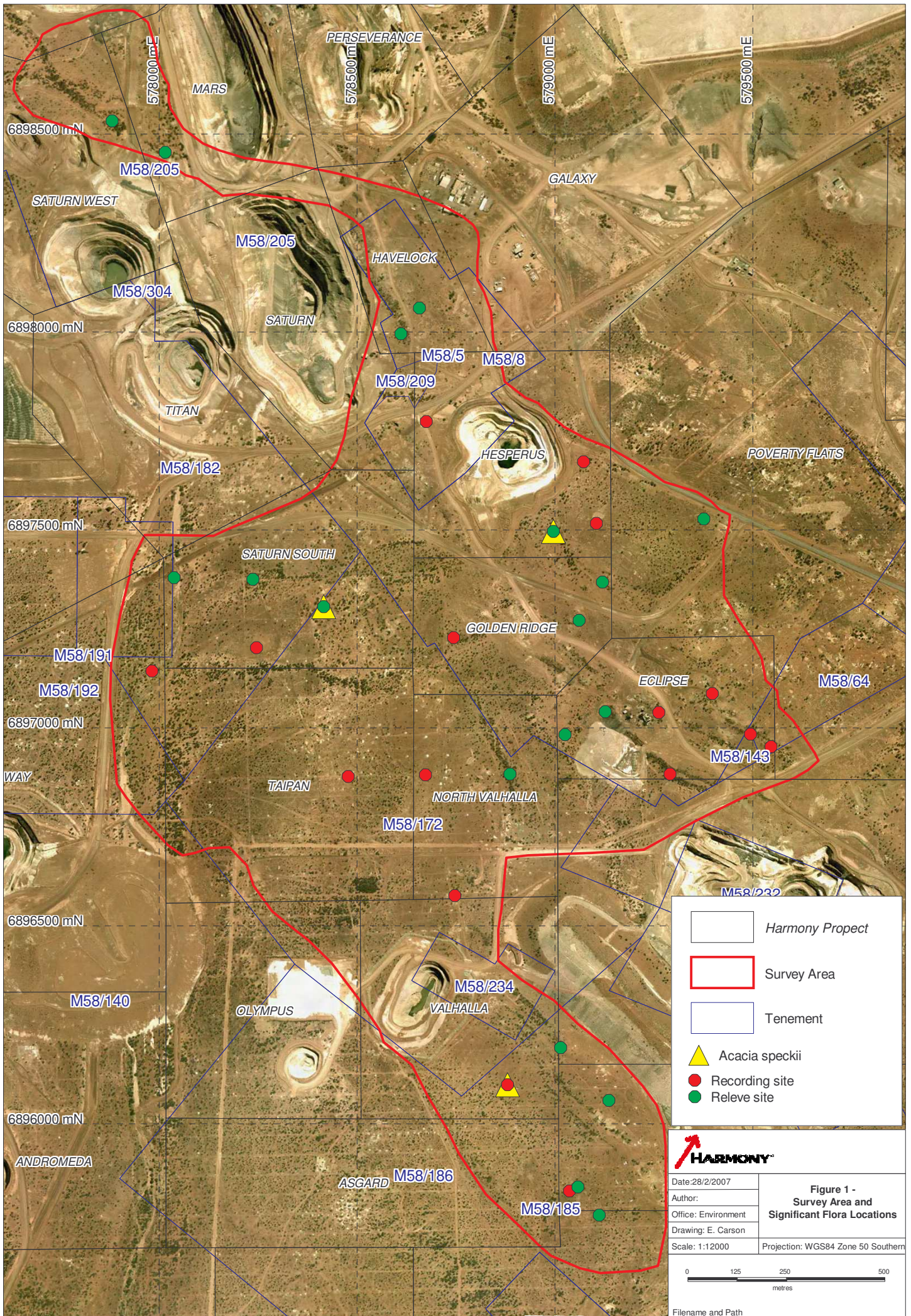
2.1 Botanical Survey

Denise True and Stephen Kern of Western Botanical conducted field surveys of the MMG tenements, during the period 10th to 15th October 2006. During this time, the survey area was traversed on foot. Relevés were conducted at sites selected to represent the diversity of vegetation types within the survey area (Figure 1). Vegetation structure at each site was described using a modification of the Muir (1977) classification system (Appendix 2). Complete species inventories were compiled at each relevé.

Any flora not readily identified in the field were collected and identified at the WA Herbarium while vouchers of all species encountered were also taken as reference material and have been retained by Western Botanical. Good quality specimens and any species with conservation significance will be vouchered at the WA Herbarium.

All locations were recorded using hand held Garmin 76 GPS with an accuracy of approximately 5m using the WGS 84 datum. Photographs were taken for reference using a five megapixel digital camera.

Selected information gathered as part of the wider surveys conducted at the time has been considered to provide a regional context on specific issues within the survey area.



| | |
|--|-----------------|
| | Harmony Project |
| | Survey Area |
| | Tenement |
| | Acacia speckii |
| | Recording site |
| | Releve site |

HARMONY

| | |
|------------------------------------|---|
| Date: 28/2/2007 | Figure 1 - Survey Area and Significant Flora Locations |
| Author: | |
| Office: Environment | |
| Drawing: E. Carson | |
| Scale: 1:12000 | |
| Projection: WGS84 Zone 50 Southern | |

0 125 250 500 metres

Filename and Path

2.2 Limitations and Constraints

Rainfall in has been below average throughout much of Western Australia in 2006. As a result there was a very low occurrence of annual herbaceous species. In addition, flowering of perennial species was also affected. Despite the seasonal affects, only three taxa could not be fully identified to species level.

3.0 Results

3.1 Flora

A total of 104 taxa from 29 families were recorded from within the survey area (Appendix 1). The majority of taxa were represented by the families: Chenopodiaceae (14 taxa), Poaceae (14 taxa), Mimosaceae (11 taxa), Amaranthaceae (8 taxa), Myoporaceae (8 taxa), Goodeniaceae (6 taxa) and Malvaceae (6 taxa).

Three taxa could not be successfully identified to species level due to insufficient flowering material. None of these taxa matched any known significant species from the region.

3.2.1 Conservation Significance of Flora

The Priority Three taxon, *Acacia speckii*, occurs within the survey area and was recorded from three sites (Figure 1). *Acacia speckii* is known from populations ranging from 100 km north of Meekatharra to Yalgoo (Florabase 2006). Surveys conducted on other BIFs within MMG tenements recorded this species from four additional locations. An estimation of population sizes were not made at the time of survey.

3.2 Vegetation

The vegetation of the survey area is mostly highly degraded from historical mining activity including grid lines, mine shafts, tracks, drilling, waste piles etc. In addition, heavy grazing by feral goats was evident. Within the semi-intact remnant vegetation seven vegetation types were distinguished.

3.2.1 Open Mulga Shrubland (OMS)

Open Mulga Shrubland was the most extensive vegetation type encountered in the survey area. Vegetation is dominated by *Acacia ramulosa* var. *ramulosa*, *Acacia aneura* var. *fuliginea* open scrub over *Monachather paradoxus*, *Eragrostis eriopoda* scattered grass.



Plate 1: Open Mulga Shrubland (Hesperus)

3.2.2 Open Chenopod Shrubland (OCS)

Vegetation is dominated by *Acacia aneura* var. *aneura*, *Acacia grasbyi*, *Hakea preissii* scattered tall shrubs over *Maireana triptera*, *Sclerolaena densiflora* open dwarf scrub.



Plate 2. Open Chenopod Shrubland (Golden Stream)

3.2.3 Mulga Shrubland on Banded Ironstone (BIF)

A discontinuous BIF ridge runs North/South through the survey area. Mulga Shrubland on Banded Ironstone vegetation dominates these rocky outcrops. Vegetation is dominated by *Acacia aneura* var. *fuliginea* open scrub over *Aluta aspera* subsp. *hesperia*, *Eremophila latrobei*, *Thryptomene decussata* open low scrub over *Monachather paradoxus*, *Aristida contorta* scattered grasses.



Plate 3. Banded Ironstone Mulga Shrubland (Golden Stream)

3.2.4 Open Mulga-Chenopod Stony Plain (MCS)

Vegetation is dominated by *Eremophila fraseri* subsp. *galeata*, *Acacia aneura* var. *aneura* open low scrub over scattered chenopods and grasses.



Plate 4. Open Mulga-Chenopod Stony Plain

3.2.5 Mulga Drainage line (DrM)

Vegetation is dominated by *Acacia aneura* var. *argentea*, *A. aneura* var. *aneura*, *A. grasbyi*, *A. ramulosa* var. *ramulosa* Thicket over *Maireana triptera*, *Sclerolaena densiflora* Open Dwarf Scrub.



Plate 5. Mulga Drainage Line (Brown Hill)

3.2.6 Calytrix shrubs (Cx)

A small, distinctive area (approx. <1ha) of *Calytrix divergens* Open Dwarf Scrub on eroded duricrust. Mostly bare at the time of survey.



Plate 6. Calytrix Open Dwarf Scrub

3.2.7 Outwash Mulga Shrubland (OwS)

This community is located down slope from the Banded Ironstone ridge on soils largely composed of silt and gravel. Vegetation is dominated by *Acacia ramulosa* var. *ramulosa*, *Acacia aneura* var. *aneura* scrub over *Maireana villosa*, *Sclerolaena densifolia*, *Sclerolaena eriacantha* dwarf scrub.

4.0 Discussion

The flora of the MMG tenements is representative of the overall flora of the Austin Botanical District (Murchison Biogeographic Region) predominately mulga low woodland on plains, reduced to scrub on hills (Beard, 1990).

Within the MMG tenements a series of low lying, narrow, Banded Ironstone Formations (BIFs) ridges occur. Banded Iron Formations (BIFs) are highly prospective for iron ore though in this case adjacent to gold deposits. Most if not all of the surrounding BIFs are subject to either exploration or mining. Equally there is significant interest in the conservation values of BIF ranges, as studies have shown high levels of floristic endemism and unique ecological communities associated with these ranges.

The Department of Environment and Conservation is undertaking detailed floristic studies of the flora and vegetation of banded iron formations of the Yilgarn Ranges. The aim of the study is to expand on the currently limited knowledge of the flora and vegetation that occur on the ranges where banded ironstone occurs and to place the plant communities described during the survey into a regional context with other ranges throughout the Yilgarn Craton.

During discussions with DEC regarding further surveys of the BIFs within the MMG tenements, it was agreed that given the highly degraded nature of the site, a quadrat based approach as per the BIF Survey Protocol (Gibson & Coffey, 2006), would not result in any more meaningful data than that collected by relevés. Importantly the BIFs within the survey area have been subjected to many disturbances over a long period of time reflected in the low level of intactness and subsequent diminished conservation values. The BIFs occurring on the MMG tenements will be the subject of extensive survey during 2007-08.

Within this highly disturbed landscape exist scattered individuals of the Priority Three taxon, *Acacia speckii*, recorded at three sites within the survey area. This species typically occurs within Open Mulga Shrubland vegetation. *Acacia speckii* is known from populations ranging from 100 km north of Meekatharra to Yalgoo (Florabase 2006). Surveys conducted on other BIFs within MMG tenements recorded this species from four additional locations. It is not believed that clearing of the individuals recorded would impact the conservation status of this species.

5.0 References

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Appendix 1 Species Recorded within Survey Area

| Family | Species | BIF | OMS | MCS | OwM | OCS | Cx | DrM |
|----------------|--|-----|-----|-----|-----|-----|----|-----|
| Adiantaceae | <i>Cheilanthes lasiophylla</i> | 1 | | | | | | |
| Poaceae | <i>Aristida contorta</i> | 1 | 1 | 1 | 1 | 1 | | 1 |
| Poaceae | * <i>Cenchrus ciliaris</i> | 1 | | 1 | | 1 | | |
| Poaceae | <i>Eragrostis eriopoda</i> | 1 | 1 | | 1 | | | |
| Poaceae | <i>Austrostipa nitida</i> | 1 | 1 | 1 | | | | |
| Poaceae | <i>Eriachne pulchella</i> | 1 | 1 | | | | | |
| Poaceae | <i>Monachather paradoxus</i> | 1 | 1 | | | | | |
| Poaceae | <i>Austrostipa elegantissima</i> | | 1 | | | | | |
| Poaceae | <i>Austrostipa scabra</i> | | 1 | | | | | |
| Poaceae | <i>Cymbopogon ambiguus</i> | 1 | | | | | | |
| Poaceae | <i>Digitaria brownii</i> | 1 | | | | | | |
| Poaceae | <i>Enneapogon caerulescens</i> | 1 | | | | | | |
| Poaceae | <i>Eriachne mucronata</i> | 1 | | | | | | |
| Poaceae | <i>Paspalidium basicladum</i> | 1 | | | | | | |
| Poaceae | <i>Thyridolepis mitchelliana</i> | 1 | | | | | | |
| Proteaceae | <i>Hakea preissii</i> | | 1 | | | 1 | | |
| Proteaceae | <i>Grevillea deflexa</i> | 1 | | | | | | |
| Proteaceae | <i>Grevillea nematophylla</i> subsp. <i>supraplana</i> | 1 | | | | | | |
| Loranthaceae | <i>Amyema nestor</i> | | 1 | | | | | |
| Loranthaceae | <i>Lysiana exocarpi</i> subsp. <i>exocarpi</i> | 1 | | | | | | |
| Polygonaceae | * <i>Acetosa vesicaria</i> | 1 | | | | | | |
| Chenopodiaceae | <i>Maireana carnosa</i> | 1 | 1 | 1 | 1 | 1 | | 1 |
| Chenopodiaceae | <i>Sclerolaena densiflora</i> | 1 | 1 | 1 | 1 | 1 | | 1 |
| Chenopodiaceae | <i>Sclerolaena eriacantha</i> | 1 | | 1 | 1 | 1 | | 1 |
| Chenopodiaceae | <i>Maireana triptera</i> | | 1 | 1 | | 1 | | 1 |
| Chenopodiaceae | <i>Atriplex semilunaris</i> | | | | 1 | 1 | | |
| Chenopodiaceae | <i>Maireana villosa</i> | | | | 1 | 1 | | |
| Chenopodiaceae | <i>Sclerolaena fusiformis</i> | | 1 | 1 | | 1 | | |
| Chenopodiaceae | <i>Enchylaena x Maireana tomentosa</i> <i>x georgei</i> | | | | | 1 | | |
| Chenopodiaceae | <i>Salsola tragus</i> | | | | | 1 | | |
| Chenopodiaceae | <i>Maireana georgei</i> | 1 | 1 | 1 | 1 | | | |
| Chenopodiaceae | <i>Rhagodia drummondii</i> | | 1 | | 1 | | | |
| Chenopodiaceae | <i>Enchylaena tomentosa</i> var. <i>tomentosa</i> | 1 | 1 | | | | | |
| Chenopodiaceae | <i>Maireana pyramidata</i> | | 1 | | | | | |
| Chenopodiaceae | <i>Atriplex codonocarpa</i> | 1 | | | | | | |
| Amaranthaceae | <i>Ptilotus obovatus</i> | 1 | 1 | 1 | 1 | 1 | | 1 |
| Amaranthaceae | <i>Ptilotus divaricatus</i> var. <i>divaricatus</i> | | | | | | | 1 |
| Amaranthaceae | <i>Ptilotus exaltatus</i> | 1 | | 1 | | 1 | | |
| Amaranthaceae | <i>Ptilotus aevroides</i> | | | | | 1 | | |
| Amaranthaceae | <i>Ptilotus schwartzii</i> | 1 | 1 | 1 | | | | |

| Family | Species | BIF | OMS | MCS | OwM | OCS | Cx | DrM |
|-----------------|---|-----|-----|-----|-----|-----|----|-----|
| Amaranthaceae | <i>Ptilotus helipteroides</i> var. <i>helipteroides</i> | | 1 | | | | | |
| Amaranthaceae | <i>Ptilotus gaudichaudii</i> | 1 | | | | | | |
| Amaranthaceae | <i>Ptilotus rotundifolius</i> | 1 | | | | | | |
| Brassicaceae | <i>Lepidium platypetalum</i> | 1 | | | | 1 | | |
| Mimosaceae | <i>Acacia aneura</i> var. <i>aneura</i> | 1 | 1 | 1 | 1 | 1 | | 1 |
| Mimosaceae | <i>Acacia ramulosa</i> var. <i>ramulosa</i> | 1 | 1 | 1 | 1 | 1 | | 1 |
| Mimosaceae | <i>Acacia tetragonophylla</i> | 1 | 1 | 1 | 1 | 1 | | 1 |
| Mimosaceae | <i>Acacia grasbyi</i> | 1 | 1 | | 1 | 1 | | 1 |
| Mimosaceae | <i>Acacia aneura</i> var. <i>argentea</i> | 1 | 1 | | | 1 | | 1 |
| Mimosaceae | <i>Acacia aneura</i> var. <i>fuliginea</i> | 1 | 1 | 1 | | | | 1 |
| Mimosaceae | <i>Acacia aulacophylla</i> | 1 | | | | 1 | | |
| Mimosaceae | <i>Acacia exocarpoides</i> | 1 | 1 | | | | | |
| Mimosaceae | <i>Acacia quadrimarginea</i> | 1 | 1 | | | | | |
| Mimosaceae | <i>Acacia speckii</i> (P3) | | 1 | | | | | |
| Mimosaceae | <i>Acacia</i> sp. SOK024 | 1 | | | | | | |
| Caesalpiniaceae | <i>Senna artemisioides</i> subsp. <i>filifolia</i> | | 1 | 1 | | 1 | | 1 |
| Caesalpiniaceae | <i>Senna artemisioides</i> subsp. <i>x sturtii</i> | 1 | | | | | | |
| Zygophyllaceae | <i>Zygophyllum eremeum</i> | | | | | 1 | | |
| Rutaceae | <i>Philotheca brucei</i> subsp. <i>brucei</i> | 1 | | | | | | |
| Euphorbiaceae | <i>Euphorbia boophthona</i> | 1 | | | | | | |
| Anacardiaceae | * <i>Schinus molle</i> | | 1 | | | | | |
| Sapindaceae | <i>Dodonaea petiolaris</i> | 1 | | | | | | |
| Sapindaceae | <i>Dodonaea viscosa</i> subsp. <i>angustissima</i> | 1 | | | | | | |
| Malvaceae | <i>Abutilon cryptopetalum</i> | | | | | | | 1 |
| Malvaceae | <i>Sida</i> sp. <i>unisexual</i> (N.H. Speck 574) | 1 | 1 | | 1 | | | |
| Malvaceae | <i>Sida calyxhymenia</i> | | 1 | 1 | | | | |
| Malvaceae | <i>Sida excedentifolia</i> | 1 | 1 | | | | | |
| Malvaceae | <i>Hibiscus</i> sp. SOK034 | | 1 | | | | | |
| Malvaceae | <i>Sida atrovirens</i> | 1 | | | | | | |
| Sterculiaceae | <i>Brachychiton gregorii</i> | 1 | 1 | 1 | | | | |
| Frankeniaceae | <i>Frankenia laxiflora</i> | | | | | | | 1 |
| Cactaceae | * <i>Opuntia stricta</i> | 1 | 1 | | | | | |
| Myrtaceae | <i>Calytrix divergens</i> | | | | | | 1 | |
| Myrtaceae | <i>Aluta aspera</i> subsp. <i>hesperia</i> | 1 | | | | | | |
| Myrtaceae | <i>Micromyrtus sulphurea</i> | 1 | | | | | | |
| Myrtaceae | <i>Thryptomene decussata</i> | 1 | | | | | | |
| Asclepiadaceae | <i>Marsdenia australis</i> | 1 | | | | | | |
| Asclepiadaceae | <i>Sarcostemma viminale</i> | 1 | | | | | | |
| Lamiaceae | <i>Spartothamnella teucriflora</i> | | | 1 | | | | |

| Family | Species | BIF | OMS | MCS | OwM | OCS | Cx | DrM |
|--------------|---|-----|-----|-----|-----|-----|----|-----|
| Lamiaceae | <i>Hemigenia sp. Yalgoo (A.M. Ashby 2624)</i> | 1 | | | | | | |
| Lamiaceae | <i>Prostanthera magnifica</i> | 1 | | | | | | |
| Solanaceae | <i>Solanum lasiophyllum</i> | 1 | 1 | 1 | | 1 | | |
| Myoporaceae | <i>Eremophila clarkei</i> | 1 | 1 | 1 | 1 | | | 1 |
| Myoporaceae | <i>Eremophila jucunda subsp. jucunda</i> | 1 | 1 | 1 | 1 | | | 1 |
| Myoporaceae | <i>Eremophila fraseri subsp. galeata</i> | | | 1 | 1 | 1 | | |
| Myoporaceae | <i>Eremophila punicea</i> | | | | | 1 | | |
| Myoporaceae | <i>Eremophila forrestii subsp. forrestii</i> | 1 | | | 1 | | | |
| Myoporaceae | <i>Eremophila latrobei</i> | 1 | | | 1 | | | |
| Myoporaceae | <i>Eremophila oldfieldii subsp. angustifolia</i> | | | 1 | | | | |
| Myoporaceae | <i>Eremophila platycalyx subsp. platycalyx ms</i> | 1 | 1 | | | | | |
| Rubiaceae | <i>Psydrax rigidula</i> | | | | 1 | | | |
| Rubiaceae | <i>Psydrax suaveolens</i> | 1 | | | | | | |
| Goodeniaceae | <i>Scaevola spinescens</i> | | 1 | 1 | 1 | 1 | | 1 |
| Goodeniaceae | <i>Goodenia mimuloides</i> | | 1 | 1 | | 1 | | |
| Goodeniaceae | <i>Goodenia sp. SOK069</i> | | 1 | | | | | |
| Goodeniaceae | <i>Velleia cynopotomica</i> | | 1 | | | | | |
| Goodeniaceae | <i>Goodenia havilandii</i> | 1 | | | | | | |
| Goodeniaceae | <i>Goodenia macroplectra</i> | 1 | | | | | | |
| Stylidiaceae | <i>Stylidium longibracteatum</i> | 1 | | | | | | |
| Asteraceae | <i>Cephalipterum drummondii</i> | | 1 | | | 1 | | |
| Asteraceae | <i>Erymophyllum ramosum subsp. ramosum</i> | | 1 | 1 | | | | |
| Asteraceae | <i>Brachyscome ciliocarpa</i> | | 1 | | | | | |
| Asteraceae | <i>Myriocephalus guerinae</i> | | 1 | | | | | |
| Phormiaceae | <i>Dianella revoluta</i> | 1 | 1 | | | | | |

Appendix 2. Vegetation Classification used in survey area

| Form/Height | Canopy Cover | | | | |
|----------------------|-----------------------|---------------------|----------------------|------------------------|-------------------------|
| | Dense 70-100% | Mid-Dense 30-70% | Sparse 10-30% | Very Sparse 2-10% | Scattered <2% |
| Trees >30m | Dense Tall Forest | Tall Forest | Tall Woodland | Open Tall Woodland | Scattered Tall Trees |
| Trees 15-30m | Dense Forest | Forest | Woodland | Open Woodland | Scattered Trees |
| Trees 5-15m | Dense Low Forest A | Low Forest A | Low Woodland A | Open Low Woodland A | Scattered Low Trees A |
| Trees <5m | Dense Low Forest B | Low Forest B | Low Woodland B | Open Low Woodland B | Scattered Low Trees B |
| Mallee tree form | Dense Tree Mallee | Tree Mallee | Open Tree Mallee | Very Open Tree Mallee | Scattered Tree Mallees |
| Mallee shrub form | Dense Shrub Mallee | Shrub Mallee | Open Shrub Mallee | Very Open Shrub Mallee | Scattered Shrub Mallees |
| Shrubs >2m | Dense Thicket | Thicket | Scrub | Open Scrub | Scattered Tall Shrubs |
| Shrubs 1-2m | Dense Heath | Heath | Low Scrub | Open Low Scrub | Scattered Shrubs |
| Shrubs <1m | Dense Low Heath | Low Heath | Dwarf Scrub | Open Dwarf Scrub | Scattered Low Shrubs |
| Mat plants, Bunch | Dense Mat Plants/ | Mat Plants/ Grass/ | Open Mat Plants/ | Very Open Mat Plants/ | Scattered Mat Plants/ |
| Grass, Hummock | Grass/ Hummock Grass/ | Hummock Grass/ | Grass/ Hummock | Grass/ Hummock Grass/ | Grasses/ Hummock |
| Grass, Sedges, Herbs | Sedges/ Herbs | Sedges/ Herbs | Grass/ Sedges/ Herbs | Sedges/ Herbs | Grasses/ Sedges/ Herbs |

*Modification of the vegetation classification system of Muir (1977)