

Review of Flora, Vegetation and Conservation Values of the proposed Golden Stream Pit Harmony Gold, Mt Magnet

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Table Of Contents

1.0 Introduction.....	1
2.0 Methods	1
2.1 Botanical Survey	1
2.2 Limitations and Constraints	1
3.0 Results	3
3.1 Flora.....	3
3.2.1 Flora of Conservation Significance.....	3
3.2 Vegetation	3
3.2.1 Site 1: Open Mulga Shrubland.....	3
3.2.2 Site 2: Open Chenopod Shrubland.....	4
3.2.3 Site 3: Mulga Shrubland on Banded Ironstone.....	4
3.2.4 Site 4: Open Mulga Chenopod Stony Plain.....	5
4.0 Discussion.....	6
Summary of findings against the Clearing Principles (<i>Environmental Protection Act 1986</i>).....	7
5.0 References	8
Appendix 1. Species Recorded within Survey Area.....	9
Appendix 2. Vegetation Classification	11

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 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 (Eclipse (Kern & True, 2006a), Golden Stream) waste dumps (Hesperus (Kern & True, 2006b)) and exploration tenements. This report documents the survey of the proposed Golden Stream pit footprint.

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. The proposed Golden Stream pit footprint area was traversed on foot on the 11th October 2006. Relevés were conducted at four sites (Figure 1), selected to represent the diversity of vegetation types within the footprint. Vegetation structure at each site was described using a modification of the Muir (1977) classification system (Appendix 2). Complete species inventories were compiled within each vegetation type. 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 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 of representative habitats and known significant flora 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 at Golden Stream.

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 one taxon could not be fully identified to species level.



HARMONY

Date: 5/12/2006	Figure 1: Golden Stream Flora Survey Sites
Author:	
Office: Environment	
Drawing: E. Carson	
Scale: 1:5000	Projection: WGS84 Zone 50 Southern

0 50 100 200
metres

Filename and Path

3.0 Results

3.1 Flora

A total of 59 taxa from 22 families were recorded from within the survey area (Appendix 1). The majority of taxa were represented by the families: Chenopodiaceae (10 taxa), Mimosaceae (7 taxa), Amaranthaceae (5 taxa), Poaceae (5 taxa), Myoporaceae (5 taxa), Goodeniaceae (5 taxa) and Asteraceae (4 taxa).

One species, *Goodenia* sp. SOK069, could not be identified to species level due to insufficient flowering material. This specimen did not match any known significant species from the region.

3.2.1 Flora of Conservation Significance

The Priority Three taxon, *Acacia speckii*, occurs within the proposed pit footprint. Scattered individuals of this species were recorded during opportunistic foot traverses, towards the northern end of the proposed clearing (Figure 1). Population size and extent was not quantified at the time of survey. *Acacia speckii* occurs over an area ranging from 100 km north of Meekatharra to Yalgoo (Florabase 2006). Surveys conducted on other BIFs within MMG tenements recorded this species from seven locations. Population sizes have not been quantified at this stage.

Two undescribed species, *Hemigenia* sp. Yalgoo (A.M. Ashby 2624) and *Sida* sp. unisexual (N.H. Speck 574), were present within the survey area. *Sida* sp. unisexual (NH Speck 574) is a common and widespread shrub in the north-eastern Goldfields, often found growing in drainage foci and loamy soils on the margins of drainage lines, within Mulga Groves and similar resource-gaining sites in hardpan plains (WB 382). *Hemigenia* sp. Yalgoo (A.M. Ashby 2624) is also known to be widespread and both species do not have or warrant, conservation status.

3.2 Vegetation

Four vegetation types were distinguished within the survey area.

3.2.1 Site 1: Open Mulga Shrubland

Open Mulga Shrubland was the most extensive vegetation unit across the proposed footprint. Vegetation is characterised by *Acacia ramulosa* var. *ramulosa*, *Acacia aneura* var. *fuliginea* Open Scrub over *Monachather paradoxus*, *Eragrostis eriopoda* sparse Grass on plains with lag gravel.



Plate 1: Open Mulga Shrubland

3.2.2 Site 2: Open Chenopod Shrubland

Open Chenopod Shrubland with occasional dense shrublands on claypans. Vegetation is characterised by *Maireana triptera*, *Sclerolaena densiflora* Open Dwarf Scrub with occasional tall shrubs of *Acacia aneura* var. *aneura*, *Acacia grasbyi* and *Hakea preissii*.



Plate 2. Open Chenopod Shrubland

3.2.3 Site 3: Mulga Shrubland on Banded Ironstone

A discontinuous narrow BIF ridge runs in a North/South direction through the proposed footprint area. Mulga Shrubland on Banded Ironstone vegetation dominates these rocky outcrops. Vegetation is characterised by *Acacia aneura* var. *fuliginea* Open Scrub over *Aluta aspera* subsp. *hesperia*, *Eremophila latrobei*, *Thryptomene decussata* Open Low Scrub over *Monachather paradoxus*, *Aristida contorta* sparse Grasses.



Plate 3. Banded Ironstone Mulga Shrubland

3.2.4 Site 4: Open Mulga Chenopod Stony Plain

Numerous exploration tracks dissect this community of Open Mulga Chenopod Stony Plain, with seasonal rains it would most likely support a number of annual species. Vegetation is characterised by *Eremophila fraseri* subsp. *galeata*, *Acacia aneura* var. *aneura* Open Low Scrub over sparse chenopods and grasses.



Plate 4. Open Mulga-Chenopod Stony Plain

4.0 Discussion

The flora of the MMG tenements is representative of the overall flora of the Austin Botanical District (Murchison Bioregion), 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 and 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 these BIFs, as previous 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.

The BIFs scattered throughout the main area of existing mines and mining infrastructure are highly fragmented and have often lost many floristic elements typical of these communities.

It was agreed during discussions with DEC regarding further surveys of the BIFs within the MMG tenements, given the highly degraded nature of the site a quadrat based approach as per the BIF Survey Protocol (Gibson & Coffey, 2006), would not glean more meaningful results than those provided by the relevé method. The BIFs occurring on the MMG tenements will be the subject of extensive survey during 2007-08.

Numerous vehicle tracks from exploration activities, both historical and recent, and old diggings occur within the Golden Stream survey area, evidence of grazing by goats were also noted. Relative to the clearing proposed at Eclipse and Hesperus, the vegetation of the Golden Stream Pit footprint has been less impacted.

There are some floristic differences in the understorey species between the Mulga Shrubland on BIF communities recorded at Eclipse, Hesperus and Golden Stream (Kern & True, 2006b). Some of these differences can be attributed to the level of clearing and disturbance surrounding the BIFs.

Scattered individuals of the Priority Three taxon, *Acacia speckii*, were recorded on the northern edge of the proposed waste dump footprint. *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 seven different locations. It is not believed that clearing of the individuals recorded would have impact on the conservation status of this species.

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.

Criteria including representativeness of the area within the Bioregion, ecosystem diversity, diversity of plant species at the bioregional and local level, were used to provide an assessment of the flora and vegetation values in addressing this Principle. Acknowledging that this report does not consider the fauna values in addressing this Principle, and taking the above criteria into account it is not considered that the proposed clearing comprises a high level of biological diversity.

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

There were no observations of flora that will be impacted by the clearing that are known as Declared Rare Flora under the *Wildlife Conservation Act 1950*. Scattered individuals of the Priority Three taxon, *Acacia speckii*, were recorded within the proposed pit footprint. *Acacia speckii* is known to occur between the area 100 km north of Meekatharra and Yalgoo (Florabase 2006). During the survey period it was recorded from seven different locations within MMG tenements. It is believed that clearing of the individuals recorded at the Golden Stream footprint would not impact on the conservation status of this species.

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. None of vegetation types recorded was considered to fit the criteria to be considered as a threatened ecological community.

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.

5.0 References

- Beard J.S. (1990) *Plant Life of Western Australia*. Kangaroo Press, Australia.
- Cockerton, G and True, D. (2006c) Review of Flora, Vegetation and Conservation Values of Portions of the Mt Keith Tenements, September 2006. Report Ref.: WB382.
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- Kern S. & True D.E. (2006a) Review of Flora, Vegetation and Conservation Values of the proposed Eclipse Waste Dump Harmony Gold, Mt Magnet, October 2006. Report Ref.: WB396.
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- Muir, B.G. (1977) Biological Survey of the Western Australian Wheatbelt. Part II: Vegetation and habitat of the Bending Reserve. *Records of the Western Australian Museum*, Suppl. No. 3.

Appendix 1. Species Recorded within Survey Area

Family #	Family	Species	Site 1	Site 2	Site 3	Site 4	Opp
7	Adiantaceae	<i>Cheilanthes lasiophylla</i>					1
31	Poaceae	<i>Aristida contorta</i>	1	1	1	1	
31	Poaceae	<i>Austrostipa elegantissima</i>					1
31	Poaceae	<i>Eragrostis eriopoda</i>	1				
31	Poaceae	<i>Eriachne pulchella</i>	1		1		
31	Poaceae	<i>Monachather paradoxus</i>	1		1		
54E	Phormiaceae	<i>Dianella revoluta</i>			1		
90	Proteaceae	<i>Grevillea deflexa</i>			1		
90	Proteaceae	<i>Hakea preissii</i>		1			
97	Loranthaceae	<i>Amyema nestor</i>					1
105	Chenopodiaceae	<i>Atriplex semilunaris</i>					1
105	Chenopodiaceae	<i>Enchylaena tomentosa var. tomentosa</i>	1				
105	Chenopodiaceae	<i>Maireana carnosia</i>		1			
105	Chenopodiaceae	<i>Maireana georgei</i>	1			1	
105	Chenopodiaceae	<i>Maireana pyramidata</i>					1
105	Chenopodiaceae	<i>Maireana triptera</i>		1			
105	Chenopodiaceae	<i>Rhagodia drummondii</i>					1
105	Chenopodiaceae	<i>Sclerolaena densiflora</i>		1			
105	Chenopodiaceae	<i>Sclerolaena eriacantha</i>					1
105	Chenopodiaceae	<i>Sclerolaena fusiformis</i>					1
106	Amaranthaceae	<i>Ptilotus aervoides</i>		1			
106	Amaranthaceae	<i>Ptilotus exaltatus</i>					1
106	Amaranthaceae	<i>Ptilotus helipteroides var. helipteroides</i>					1
106	Amaranthaceae	<i>Ptilotus obovatus</i>	1	1			
106	Amaranthaceae	<i>Ptilotus schwartzii</i>	1			1	
163	Mimosaceae	<i>Acacia aneura var. aneura</i>		1		1	
163	Mimosaceae	<i>Acacia aneura var. fuliginea</i>	1		1		
163	Mimosaceae	<i>Acacia grasbyi</i>		1			
163	Mimosaceae	<i>Acacia quadrimarginea</i>	1				
163	Mimosaceae	<i>Acacia ramulosa var. ramulosa</i>	1			1	
163	Mimosaceae	<i>Acacia speckii (P3)</i>					1
163	Mimosaceae	<i>Acacia tetragonophylla</i>				1	
164	Caesalpinaceae	<i>Senna artemisioides subsp. filifolia</i>	1	1			
175	Rutaceae	<i>Philotheca brucei subsp. brucei</i>					1
185	Euphorbiaceae	<i>Euphorbia boophthona</i>			1		
207	Sapindaceae	<i>Dodonaea viscosa subsp. angustissima</i>					1
221	Malvaceae	<i>Sida excedentifolia</i>			1		
221	Malvaceae	<i>Sida sp. unisexual (N.H. Speck 574)</i>					1
223	Sterculiaceae	<i>Brachychiton gregorii</i>				1	
273	Myrtaceae	<i>Aluta aspera subsp. hesperia</i>			1		
273	Myrtaceae	<i>Thryptomene decussata</i>			1		
305	Asclepiadaceae	<i>Marsdenia australis</i>			1		
305	Asclepiadaceae	<i>Hemigenia sp. Yalgoo (A.M. Ashby 2624)</i>					1
313	Lamiaceae	<i>Spartothamnella teucriflora</i>				1	
315	Solanaceae	<i>Solanum lasiophyllum</i>		1			
326	Myoporaceae	<i>Eremophila clarkei</i>				1	
326	Myoporaceae	<i>Eremophila fraseri subsp. galeata</i>				1	
326	Myoporaceae	<i>Eremophila jucunda subsp. jucunda</i>	1		1	1	
326	Myoporaceae	<i>Eremophila latrobei</i>			1		
326	Myoporaceae	<i>Eremophila platycalyx subsp.</i>					1

Family #	Family	Species	Site 1	Site 2	Site 3	Site 4	Opp
		<i>platycalyx ms</i>					
341	Goodeniaceae	<i>Goodenia SOK069</i>	1				
341	Goodeniaceae	<i>Goodenia macroplectra</i>			1		
341	Goodeniaceae	<i>Goodenia mimuloides</i>		1			
341	Goodeniaceae	<i>Scaevola spinescens</i>		1			
341	Goodeniaceae	<i>Velleia cynopotomica</i>	1				
345	Asteraceae	<i>Brachyscome ciliocarpa</i>					1
345	Asteraceae	<i>Cephalipterum drummondii</i>		1			
		<i>Erymophyllum ramosum subsp.</i>					
345	Asteraceae	<i>ramosum</i>					1
345	Asteraceae	<i>Myriocephalus guerinae</i>					1

Appendix 2. Vegetation Classification

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 Grass, Hummock Grass, Sedges, Herbs	Dense Mat Plants/ Grass/ Hummock Grass/ Sedges/ Herbs	Mat Plants/ Grass/ Hummock Grass/ Sedges/ Herbs	Open Mat Plants/ Grass/ Hummock Grass/ Sedges/ Herbs	Very Open Mat Plants/ Grass/ Hummock Grass/ Sedges/ Herbs	Scattered Mat Plants/ Grasses/ Hummock Grasses/ Sedges/ Herbs

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