MOUNT GIBSON MINING LIMITED

TARGETED SURVEY AT MT GIBSON FOR A NEW *LEPIDOSPERMA* SP. MT GIBSON

VERSION 2

AUGUST 2006

REPORT NO: 2006/090

ATA Environmental
environmental scientists

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Checked by: Signed:

Name: Shaun Grein Date: 21August 2006

Manager – Field Ecology

Technical Review by: Signed:

Name: Shaun Grein Date: 21 August 2006

Manager – Field Ecology

Approved by: Signed:

Name: Martine Scheltema Date: 21 August 2006

Partner

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1. INTRODUCTION

Mount Gibson Mining Limited is proposing to commence iron ore mining operations on specific sections of the Mt Gibson Ranges in the Mid West Region of Western Australia. The Mt Gibson Ranges are located approximately 350km north east of Perth, immediately adjacent to the Great Northern Highway between Wubin and Paynes Find (Figure 1).

The Mt Gibson Mining Iron Ore Project is a combined hematite/magnetite open cut mining operation that will produce both direct shipping grade hematite ore and magnetite concentrate.

A number of flora and vegetation surveys have been previously undertaken at Mt Gibson (Muir Environmental 1995, Bennett 2000, Armstrong & Associates 2004, ATA Environmental, 2005; CALM, 2005).

It was established from the Department of Conservation and Land Management (CALM) regional flora surveys of the Yilgarn Carton in September 2005 that a new, undescribed taxon of *Lepidosperma* (*Lepidosperma* sp. Mt Gibson (R.Meissner & Y.Caruso 3) was recorded from the Mt Gibson area (Meisser and Caruso, 2006; CALM, 2006).

As a result of the unknown distribution of *Lepidosperma* sp. Mt Gibson and the potential impacts of the proposed magnetite mine at Extension Hill on the taxon, ATA Environmental was commissioned by Mt Gibson Mining Limited to conduct a detailed and definitive survey of the Mt Gibson leases, surrounding ironstone and granites outcrops in areas with similar geology (i.e. Banded Iron Formation (BIF)) to the location from where CALM recorded the species, with a view to locating additional populations of *Lepidosperma* sp. Mt Gibson (Figure 1). Furthermore, ATA Environmental conducted targeted surveys for *Lepidosperma* sp. Mt Gibson on similar habitat to that where *Lepidosperma* sp. Mt Gibson was recorded from at Mt Gibson, on BIF within a 20km radius of the Mt Gibson leases. This included Mt Singleton, Yandhanoo Hill and the old Bonnie Mine. Additionally, a Rapid Habitat Assessment of an approximate 10,000km^2 area between Mt Gibson, Windamurra, Yalgoo and Koolanooka was conducted in a helicopter to identify potential *Lepidosperma* sp. Mt Gibson habitat.

2. *LEPIDOSPERMA* SP. MT GIBSON

2.1 Conservation Significance

The taxa, *Lepidosperma* sp. Mt Gibson (R.Meissner & Y.Caruso 3), has recently been classified as a Priority 1 taxa on the Department of Environment and Conservation's Declared Rare and Priority Flora List (Atkins, 2006).

2.2 Ecology, Habitat and Distribution

Lepidosperma sp. Mt Gibson (R.Meissner & Y.Caruso 3) is described as:

"Culms terete, scarcely finely ribbed, pale green, fully erect, culms 0.32-0.51 x 0.32-0.51mm, to 35-45cm tall. Rhizome compact. Leaves angular, distinctly diamond-shaped, pale green, compressed, 0.43 x 0.40mm, 35-45cm high. Bracts pale tan, glabrous. Base cross-hatched. Inflorescence simple or with one small branch at the base, loose-linear, 32-51mm long, 2.5-3.5mm wide. Inflorescence bract 10.0-39.1mm long. Scales 6-8, broadly triangular, white, 0.45-0.47mm long. Seeds 1.25-1.40 x 0.87-0.89mm, cream, becoming mottled brown with age, smooth, no ribs. Inner floral bract 2.01 x 0.94mm, opaque sides grading to rusty red keel. Style base caducous. Style 1.29mm to branches which are 0.55mm long. Anthers not seen. Anther filaments 2.01mm long".

Lepidosperma sp. Mt Gibson was initially thought to be taxonomically most closely related to *Lepidosperma* sp. Mt Jackson (L.Mattiske 193-2/572), which was recorded from Mt Jackson during surveys of Portman Iron Ore Ltd Kooyanobbing Expansion Project in 2001. The taxonomic status of *Lepidosperma sp* Mt Gibson has been investigated by Botanic Gardens and Parks Authority as part of research into the species funded by MGM. Initial results indicate that *Lepidosperma*. sp. Mt Gibson has been found to be more closely related to *L.costale* (and related entities) than to *L. sp.* Mt Jackson. There are clear differences in stem cross-section and seed morphology between *L. costale* and *L.* sp. Mt Gibson. *L. sp.* Mt Gibson has apparently been independently derived several times, presumably due to strong selection in the arid zone.

Key differences between *Lepidosperma* sp. Mt Gibson (R.Meissner & Y.Caruso 3) and *L.* sp. Mt Jackson are:

L. sp. Mt Gibson (R.Meissner & Y.Caruso 3)

> Culms scarcely finely ribbed, 0.32-0.51 x 0.32-0.51mm. Leaves angular, distinctly diamond-shaped, 0.43 x 0.40mm. Scales 6-8, broadly triangular, acute, 0.45-0.47mm long. Seeds 1.25-1.40 x 0.87-0.89mm, smooth, no ribs, dull. Style base caducous. Style 1.29 mm to branches which are 0.55mm long. Anther filaments 2.01 mm long.

L. sp. Mt Jackson (L.Mattiske 193-2/572)

> Culms finely ribbed, 0.73-0.80 x 0.56-0.70mm. Leaves somewhat angular and compressed, 0.47-0.61 x 0.42-0.53mm. Scales 6-7, narrowly triangular to almost linear, acuminate, 0.82-1.31mm long, apex with minute bristles. Seeds 1.73-2.43 x 0.84-1.14mm, smooth with three suture lines, glossy. Small style base present on seed apex. Style 2.10mm to branches which are 3.43mm long. Anther filaments 4.25mm long.

Although the known distribution of *Lepidosperma* sp. Mt Gibson appears to be restricted, it demonstrates traits of strong ecological resilience namely:

(i) it is a resprouting species and therefore capable of surviving fire and grazing to a greater extent than a seeder species;

(ii) *Lepidosperma* as a genera are well known to be highly resistant to root pathogens, particularly *Phytophthora*. It would be expected that L. sp Mt Gibson would have a similar resistance and would therefore be unlikely to be directly impacted by the root rot fungi;

(iii) The species demonstrates vigorous subsoil branching indicating that the plant can respond to seasonal moisture and is probably capable of producing a shoot to flower in one season; and

(iv) Clump size and branching patterns indicate that individual clumps are long lived, probably in the multiple of decades and potentially longer. Overall the species is probably long-lived, resilient to fire and grazing and disease tolerant.

Initial research by Botanic Gardens and Parks Authority indicate that the species is water rather than nutrient limited, with rapid growth rates in standard soil mixes indicating that the substrate may be less important than water harvesting attributes.

Lepidosperma sp. Mt Gibson has an unknown flowering period. As the rainfall in the region is unreliable, *Lepidosperma* sp. Mt Gibson is likely to respond opportunistically to rainfall events (i.e. tropical cyclonic summer rainfall events and southern winter cold fronts).

3. SURVEY METHODOLOGY

3.1 Approach to the Targeted Surveys

Data was collected during a targeted field survey for the species to determine the overall extent of the *Lepidosperma* sp. Mt Gibson population size and total number of plants. The targeted survey for *Lepidosperma* sp. Mt Gibson was conducted by four botanists over a five day period between 21 and 26 February 2006 (total of 20 survey days). The timing of the survey coincided with the most favourable period for identifying *Lepidosperma* sp. Mt Gibson from its distinctive pale green leaves, which tend brown off following periods of dry, hot weather. The survey was undertaken following a period of higher than average rainfall for the area. An additional follow-up survey of burnt area between Mt Gibson and Iron Hill East was conducted between 28 and 30 June 2006 to clarify plant numbers after a portion of this area was overlooked in the original February survey.

The survey was conducted by Mr Shaun Grein, Ms Gabriela Martinez, Ms Cass Gray and Ms Edith O'Shea, all experienced botanists from ATA Environmental. Prior to conducting the field survey, specimens of the taxon previously collected were provided by the Botanic Gardens and Parks Authority to allow for comparison with specimens in the field. The survey made no distinction between identification of seedlings and mature plants of the taxon. As the only previous record of *Lepidosperma* sp. Mt Gibson indicated that the preferred habitat for the species was on the upper slopes, hilltops and ridges of the Mt Gibson Range (Botanic Gardens and Parks Authority, *pers. comm*) loosely associated with BIF, these particular landforms were initially investigated during this targeted survey. Other landform types within the Mt Gibson area were selectively investigated for occurrence of the taxon.

The survey methodology consisted of traversing parallel, east-west transects, between 10m and 40m wide (depending on the density of the associated vegetation) from the hill crest or ridge of each of the ten major hills in the Mt Gibson Ranges. The start and end of each transect was flagged to avoid re-surveying. The survey of these specific landforms was modified early on during the survey when it became apparent that the taxon tended to favour gullies as its preferred habitat. Gullies associated with the survey area were identified from a Digital Elevation Model (DEM) developed for the area at a scale of 1:10,000. The length of each surveyed transect ranged between 100m to 600m, depending on the extent of the hill and gully traversed. Wherever *Lepidosperma* sp. Mt Gibson plants (or clumps of plants) were identified, the number of plants was recorded and the location (i.e. waypoint) entered to a handheld Magellen Gold Series Global Positioning System (GPS) in MGA 94 Zone 50 co-ordinates. The location and numbers of plants or clump of plants recorded during the survey were plotted on a 1:15,000 scale rectified orthophotograph of the study area following completion of the field survey.

Where it was difficult to accurately calculate the exact number of plants at a particular location due to large numbers of individual plants in a relatively small area, an estimate of the total number of plants was recorded from an indicative 20m x 20m area. The number and location of all *Lepidosperma* sp. Mt Gibson plants (or clumps of plants) recorded is provided in Appendix 1.

Photographs of plants from selected populations were taken (Plates 1-6) and specimens were retained for vouchering with the Western Australian Herbarium. Additional photographs of particular characteristics of the taxon are provided in Plates 7-9.

Following the targeted survey for *Lepidosperma* sp. Mt Gibson within the Mt Gibson Iron leases, further targeted surveys for the species were conducted on landforms and habitats similar to that where the species was recorded at Mt Gibson, on BIF and granite hills within a

20km radius of the Mt Gibson survey area. These surveys were conducted between 15-19 May 2006. The survey area included Mt Singleton, Yandhanoo Hill, the old Bonnie Mine and other smaller, unnamed BIF hills in the area.

3.2 Rapid Habitat Assessment

A helicopter-based Rapid Habitat Assessment to identify potential *Lepidosperma* sp. Mt Gibson habitat was conducted for an area approximately 10,000km^2 in area between Mt Gibson, Windamurra, Yalgoo and Koolanooka on the 5 and 6 July 2006. The assessment focussed on 30 BIF and granite hills in an area bounded Mt Gibson, Mt Magnet, Yalgoo and Koolanooka (Figure 3). The 30 hills were identified prior to conducting the assessment as being potentially prospective for *Lepidosperma* sp. Mt Gibson based on proximity to the Mt Gibson populations and similar geology and elevation to the areas where the taxa has been recorded from Mt Gibson.

The assessment was conducted by Mr Shaun Grein, who led the survey team conducting the targeted survey for the species at Mt Gibson and was therefore familiar with the particular habitat and landform the species tends to favour. Using a GPS-enable tablet PC loaded with topographic surveys maps of the region (Australian Topographic Survey, 1981) the assessment involved flying over each of the 30 hills at a high of less than 50m and searching for habitat and landforms that were similar to that habitat and landforms from where the species was recorded at Mt Gibson. Where potential *Lepidosperma* sp. Mt Gibson habitat was identified, the helicopter landed and the habitat was thoroughly groundtruthed on foot, using the same methods adopted when conducting the previous targeted surveys for the species, to confirm the presence or absence of the species.

4. RESULTS

4.1 Populations and Population Size

The ATA Environmental targeted survey of Mt Gibson undertaken in between 21 and 26 February 2006 and a follow-up survey on 28-30 June recorded eight relatively discrete populations of *Lepidosperma* sp. Mt Gibson from the Mt Gibson Ranges study area (Figure 2). The populations were well distributed on BIF hills in the study area, although no plants were recorded from Iron Hill Central and Iron Hill, where gullies with similar physical characteristics to the other hills were absent. Discrete populations are defined using the CALM definition to delineate populations (i.e. 500m separation distance between populations). The numbers of plants recorded from each population recorded during the survey targeted of the Mt Gibson Ranges is shown in Table 1.

TABLE 1
POPULATION SIZES OF *LEPIDOSPERMA* SP. MT GIBSON FROM EIGHT HILLS IN THE MT GIBSON RANGES

Name of Hill	*Lepidosperma* sp. Mt Gibson Population size
Extension North Hill (western slopes burnt December 2005)	776 plants
Extension Hill	7423 plants
Extension South Hill	4307 plants
Iron Hill North	265 plants
Iron Hill South	118 plants
Iron Hill East (Completely Burnt Jan 2003)	675 plants
Mt Gibson (Western Slopes Burnt Jan 2003)	3,617 plants
Mt Gibson South	434 plants
TOTAL	**17,615**

ATA Environmental recorded a total of 17,615 *Lepidosperma* sp. Mt Gibson plants during the February and June 2006 targeted surveys of the Mt Gibson study area. Tables indicating the locations (in MGA 94 Zone 50) of where *Lepidosperma* sp. Mt Gibson plants (or clumps of plants) were recorded and number of plants from each location (i.e. hill) is provided in Appendix 1.

The largest population of *Lepidosperma* sp. Mt Gibson was recorded from a relatively small area (~300m x 300m) at the southern extent of the Extension Hill (7423 plants). Virtually all the plants recorded from this population were recorded from the slopes and gullies at the southern extent of the Extension Hill.

The distribution of *Lepidosperma* sp. Mt Gibson tended to be evenly distributed in areas immediately upslope from gullies and on the side slopes and floors of narrow, moderate to deeply incised gullies throughout the study area. In general, plants tended to occur in clumps of 20 or more plants. There were only 41 records (8% of total number of records) of where only a single plant was recorded from a location. The highest number of plants recorded from a single location (approximately 20m x 20m in area at the southern extent of Extension Hill) was 450.

No additional populations of *Lepidosperma* sp. Mt Gibson were recorded during the 15-19 May 2006 survey of BIF hills within a 20km radius of Mt Gibson or during the Rapid Habitat Assessment of 30 hills within an area of approximately 10,000km^2 between Mt Gibson, Mt Magnet, Yalgoo and Koolanooka on the 5 and 6 July 2006.

4.2 Vegetation Communities

The 2006 ATA Environmental targeted surveys of the Mt Gibson Ranges recorded *Lepidosperma* sp. Mt Gibson from four vegetation communities within the study area. These vegetation communities were previously identified and mapped by Bennett Environmental Consulting (2000). They included three thicket and one heath community:

T1 Dense Thicket of mixed species dominated by *Acacia* species, *Allocasuarina acutivalvis* subsp. *prinsepiana, Calycopeplus paucifolius* and *Melaleuca nematophylla* over Low Shrubland in jaspilite rocks and pockets of loam.

T3 Dense Thicket dominated by *Acacia assimilis*, *Allocasuarina acutivalvis* subsp. *prinsepiana* and *Melaleuca nematophylla* over Low Shrubland of *Hemigenia* sp. Paynes Find and *Hibbertia crassifolia* in loam pockets in jaspilite rocks.

T6 Thicket of *Acacia acuaria* and *Acacia stowardii* over Low Shrubland of mixed species with large numbers of *Darwinia masonii* in loam with abundant rocks on the surface.

HS1 Low Heath of *Ptilotus obovatus* with emergent shrubs of *Acacia stowardii* and *Calycopeplus paucifolius* over Herbs in loamy clay large amongst large boulders.

The survey found that *Lepidosperma* sp. Mt Gibson was most abundant on the middle and lower slopes of the Mt Gibson Ranges. The most significant populations were recorded from the T1 and T3 vegetation communities occurring upslope of and in gullies of the southern extent of Extension Hill. In the majority of locations from where *Lepidosperma* sp. Mt Gibson was recorded, the soils ranged from skeletal on the upper slopes often in association with the margins of larger areas of exposed ironstone, BIF or granitic outcropping to deeper, sandy loams on the side slopes and of gully floor.

The occurrence of the majority of *Lepidosperma* sp. Mt Gibson plants in gullies suggests the taxon prefers habitats that provide increased water availability. It is also likely that the fissures and soils between the BIF capture and retain sufficient water to enable the plants to survive during periods of low rainfall. This is consistent with previous observations *Lepidosperma* species (R. Barrett, *pers. comm*.).

4.3 Threatening Processes

The unknown range and distribution of *Lepidosperma* sp. Mt Gibson potentially makes it susceptible to several threatening processes. The January 2003 wildfire that burnt through a significant portion of the southern area of the Mt Gibson Ranges (including all of Iron Hill East, the western slopes of Mt Gibson and the eastern slopes of Iron Hill) and as a consequence it was thought to have had a significant short-term impact on the fire sensitive species through this area. A more recent fire (December 2005) burnt out a section of the northwestern slopes of Extension Hill North. Frequent fire represents the greatest threat to the long term survival of the species as it has potential to result in the local extinction of the species which in turn may lead to a reduction in species viability and loss of genetic diversity. However the recording of a significant number of plants within the area between Mt Gibson

and Iron Hill East during the June 2006 surveys, which was burnt by the January 2003 wildfire, indicates the species may be fire tolerant.

The current proposal for Mt Gibson Mining Ltd to mine the Extension Hill area will result in the loss of approximately 8,000 plants recorded from this area during ATA Environmental survey of the Mt Gibson Ranges, representing approximately 46% of the total known number of individual plants of the species.

Other less threatening pressures on *Lepidosperma* sp. Mt Gibson include grazing by feral goats and rabbits. Although *Lepidosperma* sp. Mt Gibson is a resprouting species and therefore capable of surviving fire and grazing to a greater extent than a seeder species feral animal and fire control programmes may be implemented should pressures increase, which will assist in reducing the impact that fire and grazing pressure have on *Lepidosperma* sp. Mt Gibson.

5. CONCLUSIONS AND RECOMMENDATIONS

Within the Mt Gibson Ranges, *Lepidosperma* sp. Mt Gibson appears to be restricted in its distribution to the upper, middle and lower slopes and gullies of eight of the major hills that comprised the 6km extent of the Ranges.

A total of over 17,500 *Lepidosperma* sp. Mt Gibson plants from eight distinct populations were recorded during this during the February and June targeted surveys at Mt Gibson. This represents all known records of the taxon.

No additional *Lepidosperma* sp. Mt Gibson plants were recorded from subsequent surveys on Banded Ironstone Formation hills within a 20km radius of Mt Gibson or during the Rapid Habitat Assessment of 30 BIF and granite hills within a 10,000km^2 area between Mt Gibson, Mt Magnet, Yalgoo and Koolanooka.

Mount Gibson Mining have recently committed to funding a three plus year research program on *Lepidosperma* sp Mt Gibson to be undertaken by the Botanic Gardens and Parks Authority (BGPA), aimed at ensuring the long term conservation of the species. The research by BGPA on the species will assist in the long term protection and sustainability of the species as well providing important information on the genera.

The research program has been structured in three phases. Phase 1 of the research program, which is currently underway, is a fast tracked genetic appraisal to clarify the relationships and status of *Lepidosperma* sp Mt Gibson, assess the degree of clonality in *Lepidosperma* sp Mt Gibson and examine the genetic variation and population structure in *Lepidosperma* sp Mt Gibson within the Mt Gibson ranges. The results of Phase 1 of the research program, which is expected to show that the genetic structure of the population of *Lepidosperma* sp. Mt Gibson in the Mount Gibson area, including the degree of clonality in subpopulations, is such that the proposed mine pit will not have unacceptable direct impact on intra-species genetic diversity and species viability, will be provided to the EPA for consideration in its report and recommendations. Early evidence from BGPA is that, like all other wind pollinated species in the south west of Western Australia that have been genetically assessed, there is very little detectable genetic partitioning across the species.

The second phase of the research program will focus on the biology of *Lepidosperma* sp Mt Gibson, in particular focusing on factors relating to the long term conservation, management and restoration of *Lepidosperma* sp Mt Gibson, including research into propagation and translocation of the species. Preliminary research to date by BGPA has indicated that multiplication of plants by rhizome division is possible, albeit a highly labour intensive and expensive alternative method of propagation in the event that tissue culture and/or seed germination research fails to resolve a rapid mass-multiplication method. Initial growth experiments by BGPA indicate that the species is water rather than nutrient limited with rapid growth rates in standard soil mixes, indicating that substrate may be less important that water harvesting attributes. This is likely to have important implications for the re-establishment of the species.

Phase Three of the research program will include several topics important for the conservation of the genus in Western Australia, which is now believed to contain numerous poorly known taxa with possible conservation significance. Phase Three is therefore aimed at providing valuable information that will be widely applicable beyond the species *Lepidosperma* sp Mt Gibson.

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PLATES

Plate 1 *Lepidosperma* sp. Mt Gibson from based of southern extent of Extension Hill, Mt Gibson – 25 February 2006

Plate 2 *Lepidosperma* sp. Mt Gibson from eastern slopes of Extension Hill North, Mt Gibson – 21 February 2006

Plate 3 *Lepidosperma* sp. Mt Gibson from floor of gully on eastern slopes of Extension Hill South – 22 February 2006

Plate 4 *Lepidosperma* sp. Mt Gibson from upper western slopes of Mt Gibson hill, Mt Gibson – 22 February 2006

Plate 5 *Lepidosperma* sp. Mt Gibson from deeply incised gully between Iron Hill east and Mt Gibson, Mt Gibson – 25 February 2006

Plate 6 *Lepidosperma* sp. Mt Gibson from the southwestern slopes of Mt Gibson South, Mt Gibson – 23 February 2006

Plate 7 *Lepidosperma* sp. Mt Gibson - compact, base cross-hatched rhizome. (photo courtesy of R. Barrett)

Plate 8 *Lepidosperma* sp. Mt Gibson - inflorescence (photo courtesy of R. Barrett)

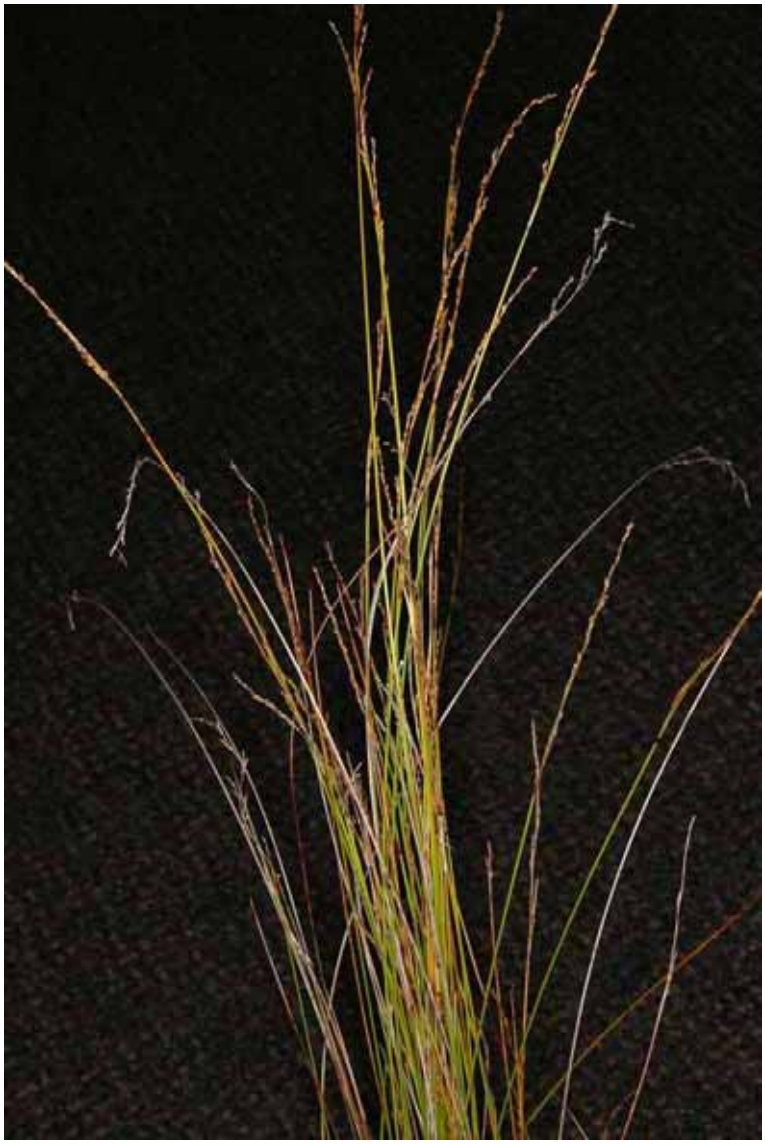
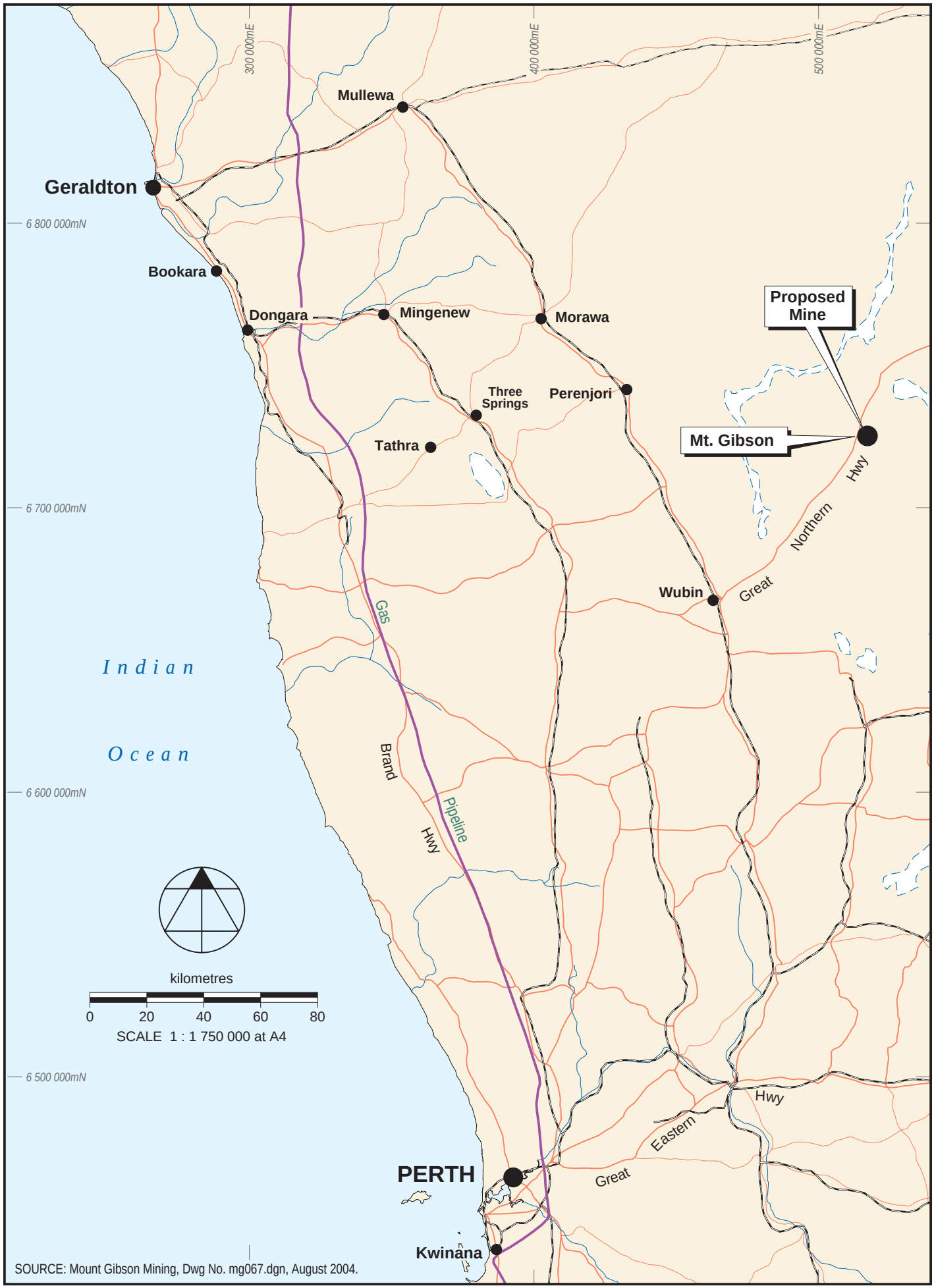


Plate 9 *Lepidosperma* sp. Mt Gibson - showing distinctive angular, diamond-shaped, pale green and compressed leaves (photo courtesy of R. Barrett)

FIGURES



PRINTED: Thu 23 Mar 06 CHECKED BY: SG 23-03-06 DRAWN BY: EDS 23-03-06 DATUM: MGA MGM-2005-004/LEPD/26_090f01.dgn

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TARGETED SURVEY AT MT GIBSON FOR A NEW *Lepidosperma* sp. Mt Gibson

REGIONAL LOCATION

FIGURE 1

PRINTED: Tue 15 Aug 06

CHECKED BY: SG/CG 15-08-06

DRAWN BY: EDS 15-08-06

DATUM: MGA

MGM-2005-004/LEPD/26_090f02.dgn

metres

0 200 400 600 800 1000

SCALE 1 : 20 000 at A3

LEGEND

Project Layout

Cadastral Boundary

Tenement Boundary

Number of Plants

1 Plant

2 - 5 Plants

6 - 15 Plants

16 - 50 Plants

51 - 500 Plants

Extension Hill North
777 Plants

Extension Hill
7424 Plants

Extension Hill South
4307 Plants

Mt Gibson
3617 Plants

Mt Gibson South
435 Plants

Iron Hill North
265 Plants

Iron Hill East
675 Plants

Iron Hill South
118 Plants

Extension Hill North

Extension Hill

Extension Hill South

Mt Gibson

Iron Hill North

Iron Hill East

Iron Hill

Iron Hill South

Mt Gibson South

G59/30

G59/34

L59/63

M59/339

M59/338

M59/455

M59/454

M59/526

M59/609

E59/1016

6728 000mN

6726 000mN

514 000mE

516 000mE

518 000mE

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TARGETED SURVEY AT MT GIBSON FOR A NEW *Lepidosperma* sp. Mt Gibson

LOCATIONS OF *Lepidosperma* sp. Mt Gibson WITHIN THE MT GIBSON MINING LTD LEASES

FIGURE 2

PRINTED: Mon 21 Aug 06

DRAWN: GLM 17-8-06

CHECKED: SG 17-8-06

DATUM: Placed to MGA50

MGM-5-4/LEPD/26_90F3.dgn

kilometres

0 5 10 15 20 25

SCALE 1 : 750 000 @ A3

LEGEND

- Rapid Assessed Sites

MOUNT MAGNET

YALGOO

WOLLA WOLLA

Bilbertha Hill

Edamurta Range

Groove Nest Range

Darn Hill

Nongutiming Hill

Mugga Mugga Hill

Buddadoo Range

Brandy Hill

Murdaburia Hill

Wollanoo Hill

Golden Grove Mine

Mougoodeera

Bullajungadeah Hills

Walagnumming Hill

Warriedar Hill

Nyalling Hill

Blue Hills

Windaning Hill

Old Karara

Mt Mulgine

Bojada Hill

MORAWA

KOOLANOOKA

Koolanooka

Damperwah Hills

Rathsay Mine

Nyounda Hill

PAYNES FIND

Mt Edon

Warrdagga Hill

PERENJORI

THREE SPRINGS

CARNAMAH

Mt. Gibson

BASE SOURCE: AUSTRALIAN 1 : 100,000 TOPOGRAPHIC SURVEY, 1981 ;

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TARGETED SURVEY AT MT GIBSON FOR A NEW *Lepidosperma* sp. Mt Gibson

BIF / GRANITE HILLS SURVEYED DURING RAPID HABITAT ASSESSMENT

FIGURE 3

APPENDICES

APPENDIX 1

LOCATION AND NUMBER OF PLANTS OF *LEPIDOSPERMA* SP. MT GIBSON RECORDED FROM THE MT GIBSON AREA

Location and Number of Plants of *Lepidosperma* sp. Mt Gibson Recorded from Extension Hill

No. of Plants	Easting (MGA 94)	Northing (MGA 94)
5	515890	6727693.32
5	515844.71	6727625.06
5	515830.22	6727652.78
5	515814.13	6727693.43
6	515898.02	6727660.07
7	515849.61	6727667.53
8	515849.56	6727632.44
8	515891.53	6727636.07
10	515846.32	6727623.21
10	515854.48	6727684.14
10	515859.34	6727697.06
10	515896.42	6727665.61
10	515888.32	6727643.47
10	515825.4	6727667.56
10	515835.09	6727674.93
10	515831.89	6727689.71
10	515785.01	6727643.61
10	515809.05	6727525.39
10	515393.41	6728113.21
15	515888.33	6727656.39
19	515862.56	6727691.52
20	515851.24	6727680.45
20	515897.98	6727624.99
20	515844.61	6727553.04
20	515810.89	6727680.51
20	515801.18	6727665.75
20	515804.39	6727649.12
20	515809.13	6727577.1
20	515812.3	6727538.31
20	515812.27	6727516.15
20	515807.4	6727494
20	515393.41	6728113.21
30	515894.63	6727545.58
30	515809.16	6727601.1
40	515886.56	6727540.05
50	515863.92	6727512.38
50	515841.32	6727510.57
50	515844.66	6727593.67
50	515810.76	6727591.87
50	515810.61	6727486.61
70	515847.79	6727523.49
80	515855.83	6727501.32
100	515893.12	6727617.6
100	515897.95	6727610.21
100	515901.16	6727597.28
100	515901.15	6727584.35
100	515899.52	6727573.28
100	515896.28	6727567.74
100	515894.65	6727556.66
100	515842.91	6727495.79
100	515844.58	6727532.73
100	515846.23	6727562.27
100	515844.68	6727606.59
1	515859.4	6727743.23

Location and Number of Plants of *Lepidosperma* sp. Mt Gibson Recorded from Extension Hill

1	515833.56	6727734.03
1	515830.33	6727734.04
4	515823.88	6727735.89
6	515825.5	6727737.74
6	515820.66	6727743.28
12	515819.05	6727745.13
11	515988.38	6727632.24
60	515985.15	6727634.09
20	515980.31	6727632.26
30	515978.69	6727632.26
48	515970.63	6727637.81
40	515967.4	6727635.97
30	515965.78	6727634.12
20	515959.33	6727635.98
20	515957.72	6727637.83
60	515954.49	6727641.53
10	515943.2	6727639.69
35	515931.89	6727636.02
12	515917.36	6727634.19
1	515999.69	6727641.46
1	515951.19	6727589.82
1	515943.13	6727589.83
12	515941.51	6727589.84
10	515931.81	6727582.46
250	515905.95	6727560.34
150	515902.73	6727562.19
100	515901.12	6727565.89
300	515902.74	6727569.58
50	515897.9	6727573.28
10	515878.54	6727577
25	515876.92	6727577
1	515993.1	6727547.29
2	515986.64	6727541.76
6	515985.02	6727538.07
5	515983.32	6727478.98
9	515980.08	6727473.44
10	515976.85	6727471.6
7	515970.4	6727477.15
20	515968.78	6727475.3
5	515962.33	6727471.62
5	515960.71	6727473.47
3	515965.56	6727479
20	515989.72	6727442.03
30	515984.88	6727440.19
18	515981.65	6727440.2
20	515975.19	6727438.36
15	515954.19	6727429.16
1	515952.59	6727432.85
2	515952.6	6727438.39
30	515955.82	6727440.23
15	515867.31	6727628.72
20	515870.56	6727639.8
15	515868.95	6727645.34
20	515873.81	6727658.26
10	515877.05	6727667.49

Location and Number of Plants of *Lepidosperma* sp. Mt Gibson Recorded from Extension Hill

6	515878.67	6727673.03
15	515880.3	6727682.26
20	515909.39	6727708.07
15	515914.22	6727700.68
50	515915.82	6727691.44
5	515910.97	6727682.21
5	515914.18	6727669.28
1	515906.08	6727647.13
3	515904.46	6727647.14
50	515914.12	6727628.66
20	515917.34	6727621.26
50	515918.95	6727615.72
15	515918.94	6727608.34
50	515912.47	6727600.96
30	515910.84	6727591.73
30	515910.83	6727582.49
50	515910.82	6727575.11
50	515909.19	6727567.72
50	515905.96	6727562.19
10	515909.18	6727556.64
30	515904.32	6727547.42
50	515875.26	6727543.76
50	515873.64	6727540.07
50	515870.41	6727534.54
50	515865.58	6727545.62
50	515870.44	6727558.54
30	515868.84	6727565.93
30	515870.47	6727577.01
50	515870.48	6727588.09
30	515873.72	6727595.47
20	515873.73	6727602.86
15	515875.36	6727610.24
18	515830.15	6727606.61
30	515830.15	6727601.07
50	515830.14	6727593.69
50	515830.13	6727589.99
30	515830.12	6727580.76
20	515828.49	6727573.38
50	515831.71	6727567.83
20	515834.93	6727560.44
10	515836.53	6727547.51
10	515838.13	6727540.12
12	515833.28	6727534.59
7	515830.04	6727525.36
20	515828.42	6727519.82
50	515830.02	6727514.28
50	515831.63	6727510.58
50	515833.24	6727505.04
50	515834.85	6727499.5
12	515836.45	6727493.96
6	515833.2	6727477.34
50	515796.1	6727495.86
50	515799.34	6727501.4
10	515802.57	6727506.93
20	515800.97	6727512.47

Location and Number of Plants of *Lepidosperma* sp. Mt Gibson Recorded from Extension Hill

20	515800.97	6727518.01
10	515796.13	6727519.87
10	515794.53	6727527.26
15	515792.92	6727532.8
7	515791.32	6727538.34
10	515791.32	6727542.03
30	515794.58	6727564.19
20	515794.6	6727577.12
20	515791.39	6727588.2
30	515744.52	6727547.64
10	515746.13	6727542.1
20	515747.73	6727536.56
6	515749.34	6727529.17
20	515728.37	6727542.12
5	515730	6727549.51
2	515731.62	6727556.89
26	515843	6727756
1	515730	6727752
450	515975	6727626
250	515905	6727619
5	515960	6727599
200	515931	6727591
400	515897	6727545
10	515977	6727490
250	515945	6727456
250	516000	6727459
22	516011	6727456
2	515969	6727423
18	515959	6727424
1	515944	6727430
10	515948	6727439
Total: 7423		

Location and Number of Plants of *Lepidosperma* sp. Mt Gibson Recorded from Extension Hill North

No. of Plants	Easting (MGA)	Northing (MGA)
1	515255.95	6729119.85
2	515187.95	6728975.9
3	515249.38	6729038.6
4	515335.03	6729103.12
5	515455.74	6728837.03
6	515284.93	6729062.56
6	515391.5	6729082.73
6	515507.39	6728827.73
10	515297.88	6729090.24
10	515346.33	6729106.8
10	515360.86	6729106.78
10	515399.56	6729069.79
10	515312.27	6728988.66
10	515484.78	6728824.06
10	515494.48	6728835.13
15	515407.57	6729025.46
20	515434.79	6728861.07
20	515465.41	6728824.09
30	515231.58	6729010.93
30	515305.94	6729077.31
30	515404.38	6729055.01
30	515322.16	6729134.53
40	515473.47	6728816.69
80	515380.11	6729016.26
1	515462	6728691.13
40	515210.59	6729005.41
10	515278.39	6729007.17
15	515288.08	6729007.16
50	515310.67	6728999.74
50	515331.65	6728990.48
50	515359.1	6728997.82
50	515349.4	6728988.6
15	515359.06	6728970.12
15	515350.99	6728970.14
3	515344.53	6728966.45
20	515521.94	6728840.63
10	515512.25	6728844.34
30	515458.94	6728811.17
20	515489.61	6728812.98
Total: 776		

Location and Number of Plants of *Lepidosperma* sp. Mt Gibson Recorded from Extension Hill South

No. of Plants	Easting (MGA)	Northing (MGA)
2	516446.44	6727380.43
4	516465.23	6726983.37
5	516567.06	6727081.09
5	516555.8	6727106.96
10	516473.33	6727003.67
10	516542.81	6727057.12
10	516555.74	6727068.18
10	516554.21	6727127.28
10	516520.74	6727419.1
10	516514.29	6727417.27
20	516549.23	6727031.26
20	516541.31	6727132.84
20	516507.83	6727419.12
20	516443.18	6727358.28
25	516457.76	6727397.04
30	516529.82	6727001.74
30	516536.29	6727012.81
30	516488.45	6727413.61
30	516467.46	6727406.26
30	516439.91	6727332.43
40	516500.75	6726996.24
40	516534.69	6727020.2
40	516524.99	6727014.67
40	516499.76	6727417.29
50	516544.37	6727018.34
50	516502.37	6726998.09
50	516492.69	6727001.79
50	516479.79	6727005.51
50	516513.72	6727029.46
50	516530	6727127.31
50	516515.45	6727110.71
50	516477.15	6727413.63
60	516433.06	6727062.82
100	516500.91	6727099.66
100	516442.75	6727066.5
200	516473.44	6727084.92
15	516280.12	6727336.35
1	516323.59	6727260.58
1	516357.5	6727269.76
2	516372.02	6727267.89
30	516355.91	6727286.38
15	516425.4	6727345.38
4	516431.87	6727349.06
6	516431.89	6727365.68
40	516145.97	6727212.82
20	516139.5	6727207.29
40	516129.81	6727205.46
40	516124.97	6727201.77
40	516115.27	6727196.24
50	516100.74	6727190.72
50	516094.28	6727187.04
100	516081.36	6727181.52
50	516078.12	6727177.83
30	516082.96	6727172.28
20	516136.23	6727177.75

Location and Number of Plants of *Lepidosperma* sp. Mt Gibson Recorded from Extension Hill South

20	516144.3	6727179.58
10	516152.38	6727181.42
50	516141.08	6727183.28
10	516091.02	6727166.73
30	516081.33	6727159.36
50	516074.87	6727157.52
50	516065.17	6727151.99
10	516060.32	6727146.46
20	516055.49	6727150.16
50	516055.49	6727155.7
50	516055.5	6727161.24
30	516052.29	6727170.48
10	516050.68	6727177.87
20	516057.14	6727179.71
20	516063.6	6727181.54
50	516065.21	6727176
50	516070.04	6727170.45
50	516076.51	6727175.98
50	516073.29	6727183.38
20	516076.53	6727188.91
20	516087.83	6727196.28
20	516089.46	6727203.67
2	516089.48	6727216.59
105	516379	6727342
200	516361	6727340
200	516343	6727340
170	516325	6727333
8	516316	6727344
14	516321	6727353
4	516317	6727273
3	516330	6727274
1	516337	6727273
26	516345	6727277
57	516357	6727278
152	516358	6727287
150	516366	6727283
115	516371	6727298
52	516388	6727301
29	516398	6727310
82	516421	6727326
75	516435	6727362
40	516518	6727460
70	516480	6727440
95	516459	6727427
34	516436	6727422
16	516423	6727425
12	516404	6727415
Total: 4307		

Location and Number of Plants of *Lepidosperma* sp. Mt Gibson Recorded from Iron Hill North

No. of Plants	Easting (MGA)	Northing (MGA)
1	516455.08	6725568.81
1	516468.02	6725585.41
1	516506.63	6725502.25
3	516464.68	6725511.55
5	516529.28	6725542.85
10	516535.76	6725555.77
10	516519.59	6725533.63
10	516513.11	6725518.87
1	516805.3	6725571.99
6	516784.32	6725572.02
1	516764.97	6725584.97
2	516739.12	6725564.7
1	516713.37	6725610.9
3	516698.87	6725629.39
4	516694.04	6725636.79
3	516694.05	6725646.02
1	516682.81	6725682.97
3	516661.81	6725668.23
5	516685.73	6725474.29
8	516829.5	6725566.41
12	516779.46	6725559.1
10	516743.92	6725536.99
15	516737.47	6725540.69
3	516727.78	6725538.86
2	516687.56	6725622.02
6	516681.11	6725623.88
11	516679.5	6725629.42
2	516676.28	6725634.97
20	516674.67	6725638.66
20	516669.84	6725644.21
8	516668.23	6725646.06
30	516665	6725642.37
10	516661.78	6725646.07
6	516648.86	6725644.24
2	516652.1	6725651.62
3	516661.79	6725657.15
7	516665.02	6725660.84
5	516647.24	6725642.4
1	516648.84	6725627.62
2	516650.44	6725622.08
6	516650.43	6725614.69
1	516650.4	6725596.22
3	516671.15	6725439.22
1	516671.14	6725429.99
Total: 265		

Location and Number of Plants of *Lepidosperma* sp. Mt Gibson Recorded from Mt Gibson South

No. of Plants	Easting (MGA)	Northing (MGA)
1	518964.8	6725642.42
2	518995.41	6725614.66
3	518956.74	6725649.82
10	519022.8	6725585.07
10	519009.89	6725585.09
10	518987.3	6725590.67
20	519005.03	6725572.17
20	518995.36	6725585.12
100	518500.21	6725772.46
100	518564.77	6725776.05
100	518882.53	6725670.26
6	518626.08	6725761.17
1	518687.66	6724946.67
3	518738.98	6725720.36
20	518747.04	6725714.8
15	518636	6725732
12	518640	6725727
2	518591	6725747
Total: 118		

Location and Number of Plants of *Lepidosperma* sp. Mt Gibson Recorded from Mt Gibson

No. of Plants	Easting (MGA)	Northing (MGA)
50	518007	6725765
18	517993	6725743
30	517997	6725730
100	517984	6725739
40	517976	6725715
30	517965	6725730
35	517964	6725691
15	517962	6725695
5	517932	6725689
2	517905	6725764
6	517935	6725780
5	517931	6725786
10	517948	6725810
6	517960	6725849
18	517959	6725828
12	517975	6725865
15	517982	6725864
17	517989	6725879
4	517958	6725911
6	517927	6725895
7	517930	6725875
2	517881	6725862
9	517867	6725845
15	517865	6725830
25	517856	6725843
10	517841	6725820
30	517823	6725834
38	517818	6725849
18	517823	6725879
20	517826	6725898
5	517837	6725883
23	517849	6725905
30	517843	6725890
16	517859	6725912
8	517891	6725965
21	517805	6725965
45	517797	6725958
100	517907	6725927
75	577804	6725939
72	517804	6725920
250	517783	6725924
200	517780	6725903
90	517769	6725917
70	517765	6725900
40	517752	6725918
65	517752	6725895
28	517737	6725908
15	517716	6725910
45	517714	6725885
5	517737	6725957
10	517737	6725938
50	517737	6725938
200	517740	6725960
40	517754	6725991
50	517754	6726013

Location and Number of Plants of *Lepidosperma* sp. Mt Gibson Recorded from Mt Gibson

20	517772	6726046
15	517732	6726019
40	517717	6726002
30	517715	6726020
35	517711	6725982
50	517708	6725989
50	517707	6725967
200	517701	6725990
60	517700	6725952
50	517680	6725970
80	517697	6725931
50	517677	6725920
40	517691	6725902
20	517688	6725879
35	517687	6725848
5	517675	6725823
12	517698	6725818
10	517715	6725810
6	517712	672790
21	517725	6725770
4	517735	67255763
12	517705	6725778
15	517720	6725725
15	517675	6725825
18	517665	6725862
25	517654	6725893
100	517646	6725909
4	517658	6725915
30	517648	6725920
2	517652	6725970
30	517655	6725948
12	517650	6725989
50	517676	6725972
140	517683	6725995
70	517680	6726010
80	517679	6726023
30	517696	6726042
Total 3617		

Location and Number of Plants of *Lepidosperma* sp. Mt Gibson Recorded from Iron Hill East

No. of Plants	Easting (MGA)	Northing (MGA)
2	517608.17	6726065.67
4	517556.55	6726082.37
5	517468.96	6725798.12
5	517635.57	6726039.78
5	517579.13	6726073.1
7	517587.19	6726062.01
8	517550.09	6726076.84
10	517499.55	6725751.9
10	517624.29	6726050.87
10	517577.52	6726069.41
10	517567.84	6726074.97
20	517481.83	6725772.24
20	517611.39	6726056.43
20	517587.19	6726065.7
30	517601.71	6726060.14
50	517609.12	6725637.24
100	517652.75	6725675.95
8	517550.56	6725347.4
3	517715.91	6725812.51
1	517723.98	6725814.34
6	517709.57	6725886.38
4	517714.42	6725891.91
7	517717.65	6725891.91
20	517724.1	6725890.05
20	517712.8	6725890.07
12	517707.98	6725899.31
5	517703.14	6725904.86
10	517701.54	6725912.25
3	517695.09	6725917.8
1	517688.64	6725915.96
20	517682.18	6725915.97
2	517675.72	6725914.14
8	517675.75	6725930.76
20	517677.37	6725932.6
2	517669.3	6725938.15
4	517666.07	6725936.31
1	517662.84	6725932.62
3	517651.53	6725927.1
3	517627.48	6726028.71
1	517622.65	6726032.41
7	517617.81	6726037.96
20	517611.36	6726037.97
3	517606.52	6726041.67
20	517601.68	6726043.52
50	517598.46	6726045.37
30	517593.62	6726047.23
20	517587.17	6726050.93
20	517583.94	6726052.78
6	517579.11	6726056.48
8	517559.74	6726054.67
5	517554.9	6726056.52
6	517580.7	6726043.55
Total: 675		

Location and Number of Plants of *Lepidosperma* sp. Mt Gibson Recorded from Iron Hill South

No. of Plants	Easting (MGA)	Northing (MGA)
4	516720.54	6725008.87
30	516731.85	6725014.39
16	516764.12	6725018.04
2	516770.62	6725045.73
1	516862.59	6725034.51
3	516935.18	6725008.55
20	516943.22	6724997.46
6	516954.53	6725001.13
2	516975.52	6725006.64
1	516951.24	6724960.51
15	516969.03	6724988.18
10	516975.49	6724986.33
4	516991.64	6724993.69
3	516999.7	6724991.83
1	517006.16	6724991.82
Total: 118		