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FORTESCUE METALS GROUP LTD

PITYRODIA SP. MARBLE BAR TARGETED FLORA SURVEY

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FORTESCUE METALS GROUP LTD

PITYRODIA SP. MARBLE BAR

TARGETED FLORA SURVEY

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EXECUTIVE SUMMARY

Fortescue Metals Group Limited (Fortescue) intends to develop the North Star Magnetite Project, located approximately 100 km south-east of Port Headland and 25 km east of the Fortescue Rail Line. The North Star Magnetite Project includes an open pit mine and support infrastructure including waste dumps, tailings dam and road access.

As part of the environmental approvals process for the North Star mine, baseline flora and vegetation surveys of the proposed mine site, infrastructure and associated access corridors were required to assess potential impacts and identify appropriate management strategies. The flora and vegetation surveys were completed by *ecologia* in 2011 (*ecologia* 2012).

Of the eight Priority Flora taxa recorded during the flora and vegetation surveys, *Pityrodia* sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4), a Priority 1 taxon, appears to be the most restricted in distribution, with only two collections previously lodged at the West Australian Herbarium, representing an estimated 77 individuals. This taxon is relatively abundant within the North Star Study Area, with 541 plants recorded to date from 14 loci (i.e. records separated by more than 500 metres). These records represent a very minor south-western extension to the taxon's range and a significant increase to total number of plants. To gain a better understanding of the regional distribution of this taxon, *ecologia* was engaged to conduct a targeted flora survey of suitable habitat outside areas covered by the previous North Star flora and vegetation surveys.

In addition to these records of *Pityrodia* sp. Marble Bar, there are also 15 locations of "*Pityrodia* sp. Panorama" from the Panorama (Sulphur Springs) project (a proposed zinc, copper and lead mine) located approximately 10 km east of the North Star survey area (Trudgen *et al.* 2002 cited in; Mattiske 2007). These records represent in excess of 257 individual plants (URS 2007). While no specimens of this *Pityrodia* have yet been lodged at the Western Australian Herbarium from the Panorama project, it has been confirmed that they represent the same taxon (Malcolm Trudgen, personal communication). We therefore include these locations in the known population of *Pityrodia* sp. Marble Bar.

Prior to commencing the field survey, an assessment of locations likely to contain suitable habitat for *Pityrodia* sp. Marble Bar was conducted based on interpretation of aerial imagery, land systems, landform and aspect. Based on known locations from the North Star survey (*ecologia* 2012), the most suitable habitat for *Pityrodia* sp. Marble Bar appears to be steep, rocky areas with a southerly or easterly aspect within the Capricorn Land System, therefore areas with these characteristics were identified as the highest priority for this survey.

This *Pityrodia* sp. Marble Bar regional survey was conducted by three botanists over 12 days from 12 to 23 April 2012 (432 person hours). A preliminary inspection of areas of potential habitat from vehicle tracks was conducted using binoculars, which was followed by walking transects to confirm (or refute) potential occurrences.

A total of 688 *Pityrodia* sp. Marble Bar plants from 10 loci (separated by at least 500m) were recorded from this targeted survey, of which 34 plants are from locations at which *Pityrodia* sp. Panorama was recorded in an earlier survey (Trudgen *et al.* 2002 cited in; Mattiske 2007). In total, 654 additional *Pityrodia* sp. Marble Bar plants were recorded during the current survey.

The most populous occurrence of *Pityrodia* sp. Marble Bar (438 plants) is located on Panorama Station to the east of North Star. This location also represents the most eastern record of the taxon. A new location with 115 plants lies to the west of all previously known locations.

In total, 1521 *Pityrodia* sp. Marble Bar plants have now been recorded. Of these 980 (64.4%) occur outside (at 15 loci separated by at least 500 m), and 541 (35.6%) within the North Star flora and vegetation survey area (at 14 loci).

Of the 541 *Pityrodia* sp. Marble Bar individuals known from within the North Star survey area, 254 (47%) occur at a single locus, and over 91% of the individuals occur at the 5 most populous loci. The remaining nine loci represent less than 9% of the individuals from within the North Star survey area. Of the 980 *Pityrodia* sp. Marble Bar individuals known from outside the North Star survey area, over 44% are from the single most populous locus.

The current survey has resulted in a significant expansion of the known number of plants of this taxon, the majority of which lie beyond the boundaries of the North Star Magnetite Project area. However, all records to date occur within an area approximately 20 km from north to south and 30 km from east to west, and the distribution remains highly localised. Despite searching suitable habitat in all directions around known locations (and up to 75 km in suitable habitat to the east) no substantial extension to this species' range was recorded.

It remains possible that the species is endemic to this area and its current conservation status (Priority 1) is justified.

Some areas, particularly areas of Panorama Station could not be searched due to limitations of access. Further potential habitat exists, particularly to the east and south of the locations identified in the Panorama (Sulphur Springs) project (Trudgen *et al.* 2002 cited in; Mattiske 2007), which are inaccessible to vehicles. It is likely that additional locations of *Pityrodia* sp. Marble Bar will be found if these areas are surveyed.

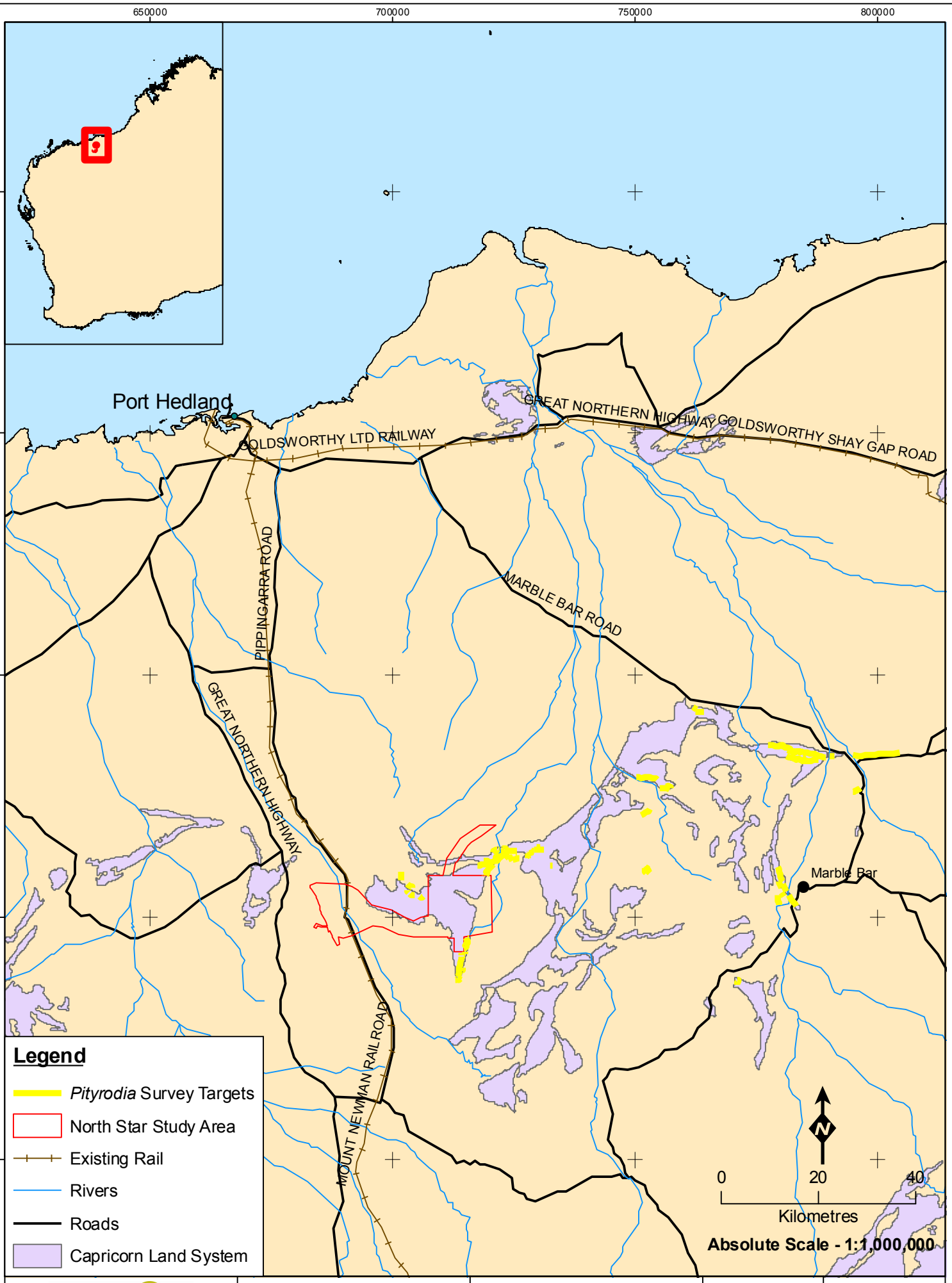
1 INTRODUCTION

1.1 BACKGROUND

Fortescue Metals Group Limited (Fortescue) intends to develop the North Star Magnetite Project, located approximately 100 km south-east of Port Headland and 25 km east of the Fortescue Rail Line (Figure 1.1). The North Star Magnetite Project includes an open pit mine and support infrastructure including waste dumps, tailings dam and road access.

As part of the environmental approvals process for the North Star mine, baseline flora and vegetation surveys of the proposed mine site, infrastructure and associated access corridors were required to assess potential impacts and identify appropriate management strategies. The flora and vegetation surveys were completed by *ecologia* in 2011 (*ecologia* 2012).

Of the eight Priority Flora taxa recorded during the flora and vegetation surveys, *Pityrodia* sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4), a Priority 1 taxon, appears to be the most restricted in distribution, with only two collections previously lodged at the West Australian Herbarium (see Appendix A for conservation categories). One of these collections is from within the North Star Study Area and the other approximately 2 km north-east of North Star Study Area. This taxon is relatively abundant within the North Star Study Area, with 541 plants recorded to date from 14 loci. Loci represent records separated by more than 500 metres, consistent with DEC guidelines for Threatened and Priority Flora (Stack 2010). These records represent a very minor south-western extension to the taxon's range and a significant increase to total number of plants. To gain a better understanding of the regional distribution of this taxon, *ecologia* was engaged to conduct a targeted flora survey of suitable habitat outside areas covered by the previous North Star flora and vegetation surveys.



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Pityrodia sp. Marble Bar Survey Area

Figure: 1.1
Project ID: 1416

Drawn: MM
Date: 26/07/2012

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

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1.2 *PITYRODIA* SP. MARBLE BAR

Pityrodia sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4) is a many-branched shrub to 2 m tall with grey, densely hairy leaves and pink flowers that appear from July to September (Plate 1.1). It is a member of the Lamiaceae, but is yet to be formally described. It has previously been recorded from sandstone hill slopes with skeletal brown sandy loam.

Plate 1.1 - Photograph of *Pityrodia* sp. Marble Bar (*ecologia 2011)*

Prior to the North Star Flora and Vegetation Survey (*ecologia* 2012), *Pityrodia* sp. Marble Bar was known from only two locations, representing a total estimated population of 77 plants (Western Australian Herbarium 1998-2012). One of these locations (PERTH 08253749), at which approximately 50 plants were estimated to occur, lies approximately 2 km north-east of the existing North Star Camp, within the North Star flora and vegetation survey area. The other location (PERTH 08253757), at which 27 plants were recorded, lies approximately 10 km north-east of North Star camp, outside the North Star flora and vegetation survey area (Table 1.1 and Figure 1.2). During the North Star flora and vegetation surveys several new locations of the Priority 1 plant, *Pityrodia* sp. Marble Bar were identified in and around the North Star survey area (*ecologia* 2012). In total an additional 610 individuals were recorded, 541 from within the North Star Flora survey area and 69 individuals outside the North Star survey area (see Appendix B for all previously known locations).

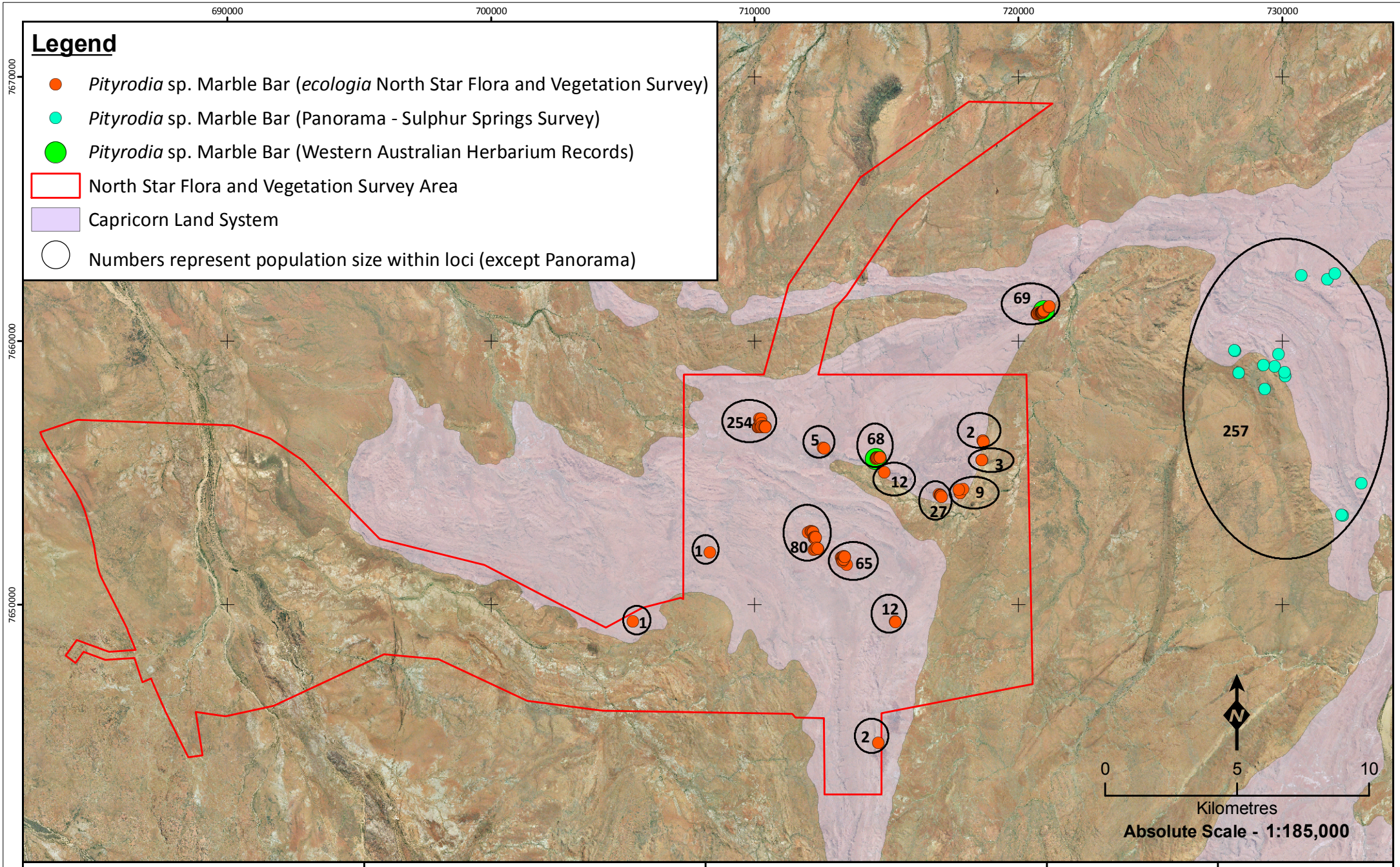
In addition to these records of *Pityrodia* sp. Marble Bar, there are also 15 locations of "*Pityrodia* sp. Panorama" from the Panorama (Sulphur Springs) project (a proposed zinc, copper and lead mine)

located approximately 10 km east of the North Star survey area (Trudgen *et al.* 2002 cited in; Mattiske 2007). These records represent in excess of 257 individual plants (URS 2007). While no specimens of this *Pityrodia* have yet been lodged at the Western Australian Herbarium from the Panorama project, it has been confirmed that they represent the same taxon (Malcolm Trudgen, personal communication). We therefore include these locations in the known population of *Pityrodia* sp. Marble Bar (Table 1.1, Figure 1.2 and Appendix B).

Table 1.1 – Previously Known Population of *Pityrodia* sp. Marble Bar (number of individuals).

Location	Western Australian Herbarium (1998-2012)	Panorama Survey (Trudgen *et al.* 2002, cited in Mattiske 2007)	North Star Survey (*ecologia* 2012)	Total	Percent of Known Population
Inside North Star Survey Area	50	0	541	541	62.4%
Outside North Star Survey Area	27	257	69	326	37.6%
Total	77	257	610	867	100%

Note: Rows do not add because North Star Survey (*ecologia* 2012) includes re-counts of Western Australian Herbarium locations.



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All Previously Known *Pityrodia* sp. Marble Bar Locations

Figure: 1.2
Project ID: 1416

Drawn: MM
Date: 26/07/2012

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

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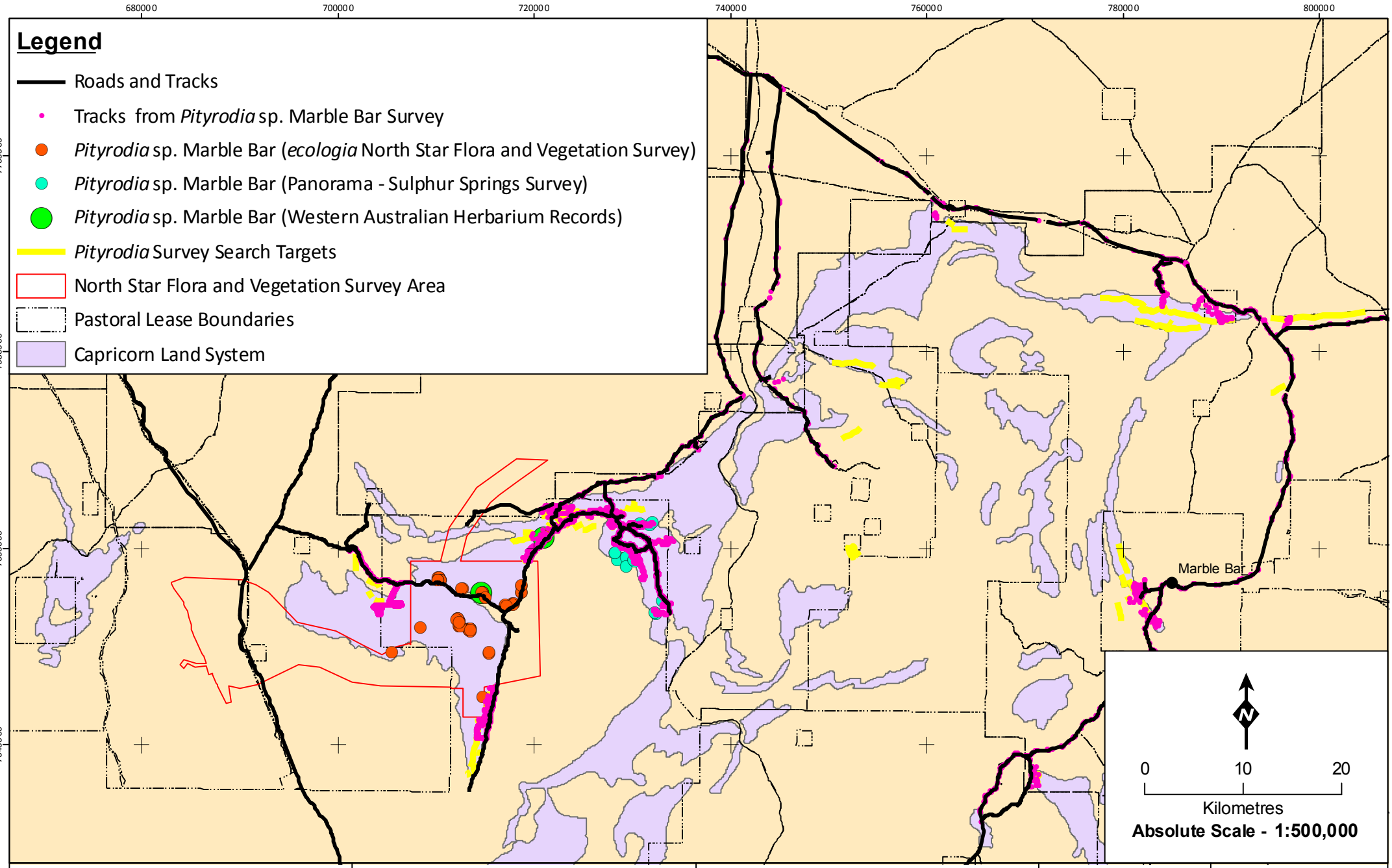
2 METHODS

Prior to commencing the field survey, an assessment of locations likely to contain suitable habitat for *Pityrodia* sp. Marble Bar was conducted based on interpretation of aerial imagery, land systems, landform and aspect. Based on known locations from the North Star survey (*ecologia* 2012), the most suitable habitat for *Pityrodia* sp. Marble Bar appears to be steep, rocky areas with a southerly or easterly aspect within the Capricorn Land System, therefore areas with these characteristics were identified as the highest priority for this survey.

This *Pityrodia* sp. Marble Bar regional survey was conducted by three botanists over 12 days from 12 to 23 April 2012 (432 person hours). A preliminary inspection of areas of potential habitat from vehicle tracks was conducted using binoculars, which was followed by walking transects to confirm (or refute) potential occurrences. *Pityrodia* sp. Marble Bar has a relatively distinctive grey colour and upright habit, and thus potential occurrences can be identified from a distance using binoculars. A voucher specimen was collected for subsequent verification at each occurrence and the location recorded using a hand-held GPS. The abundance at each location was recorded. A number of longer foot traverses were also be undertaken through areas of high habitat suitability but without vehicle access (Figure 2.1). Some areas of suitable habitat were not investigated because they were too far from existing tracks to be safely surveyed (> 2 km from nearest safely passable track).

Pityrodia sp. Marble Bar is known to flower between July and September (Western Australian Herbarium 1998-2012), (*ecologia* 2012). However, it can be distinguished when sterile by the entire, grey, hairy leaves and upright habit, and is unlikely to be confused with other co-occurring species. It was therefore possible to undertake this targeted search outside the known flowering period, but the presence of flowers may have made the plant more obvious from a distance. At the time of this survey, the *Pityrodia* sp. Marble Bar was actively growing and in full-leaf.



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Pityrodia sp. Marble Bar Regional Survey Tracks

Figure: 2.1
Project ID: 1416

Drawn: MM
Date: 26/07/2012

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

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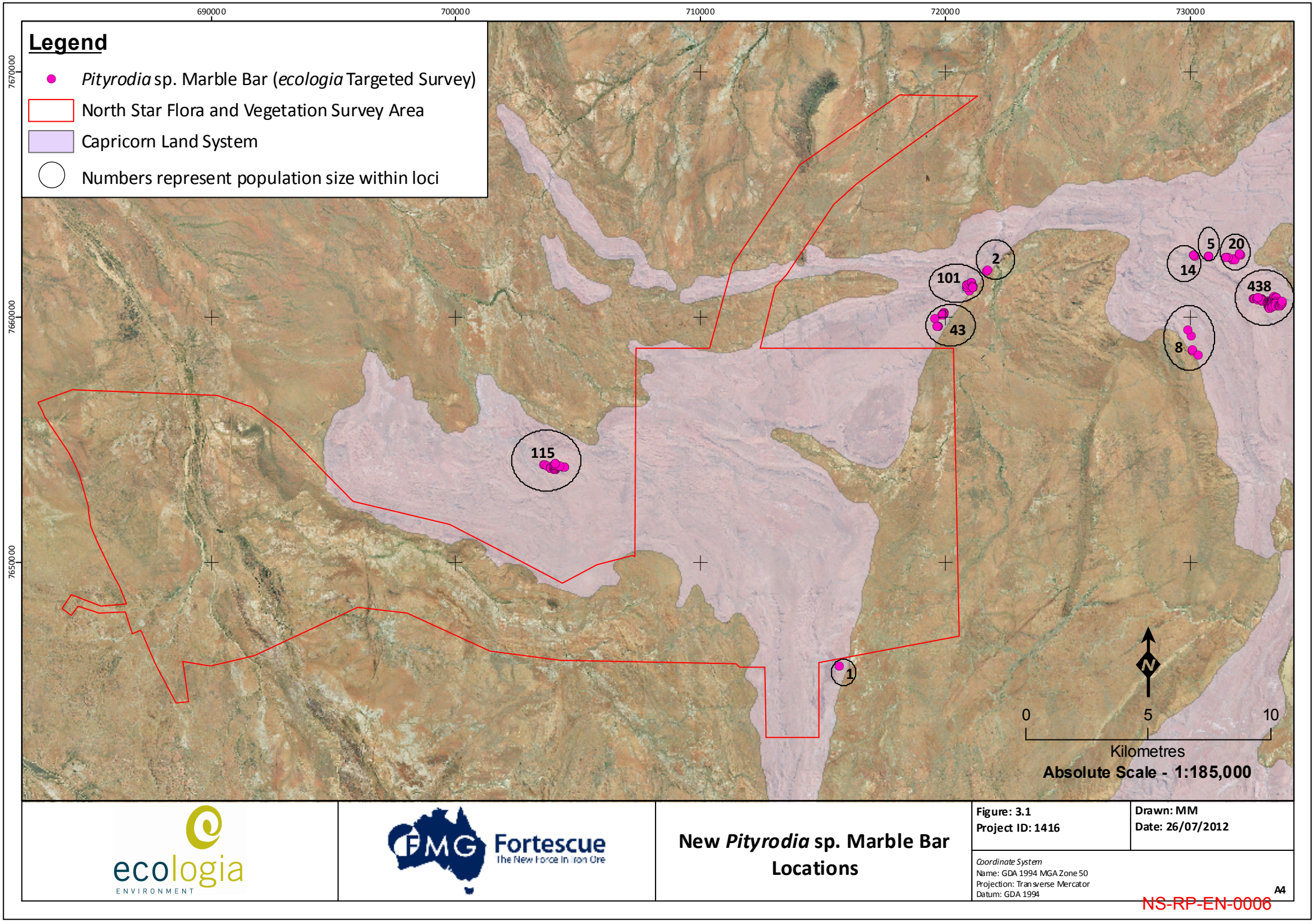
3 RESULTS

A total of 688 *Pityrodia* sp. Marble Bar plants from 10 loci (separated by at least 500m) were recorded from this targeted survey (Figure 3.1), of which 34 plants are from locations at which *Pityrodia* sp. Panorama was recorded in an earlier survey (Trudgen *et al.* 2002 cited in; Mattiske 2007). While no specimens of *Pityrodia* sp. Panorama have yet been lodged with the Western Australian Herbarium, it has now been confirmed that this taxon is synonymous with *Pityrodia* sp. Marble Bar (Malcolm Trudgen, personal communication). In total, 654 additional *Pityrodia* sp. Marble Bar plants were recorded during the current survey. Coordinates for all new records are detailed in Appendix C. Threatened and Priority Report Forms for specimens lodged with the Western Australian Herbarium are provided in Appendix D.

The most populous occurrence of *Pityrodia* sp. Marble Bar (438 plants) is located on Panorama Station to the east of North Star. This location also represents the eastern-most known extent of the taxon. A new location with 115 plants lies to the west of all previously known locations. Table 3.1 details the number of loci at which records are separated by more than 500 metres from all other records.

Table 3.1 – *Pityrodia* sp. Marble Bar Loci (separated by > 500 m).

Location	Number of Locations	Number of Individuals
New location to west	53	115
New location to south	1	1
New location to north-east	14	43
Near previously known location to north-east (Western Australian Herbarium)	28	29
New location to north-east	2	2
New Panorama location	3	14
Near previously known Panorama location (Trudgen *et al.* 2002 cited in; Mattiske 2007)	3	5
Near previously known Panorama location (Trudgen *et al.* 2002 cited in; Mattiske 2007)	13	20
New Panorama location	220	438
Near previously known Panorama location (Trudgen *et al.* 2002 cited in; Mattiske 2007)	6	21
Total	343	688



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New *Pityrodia* sp. Marble Bar Locations

Figure: 3.1
Project ID: 1416

Drawn: MM
Date: 26/07/2012

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

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4 DISCUSSION

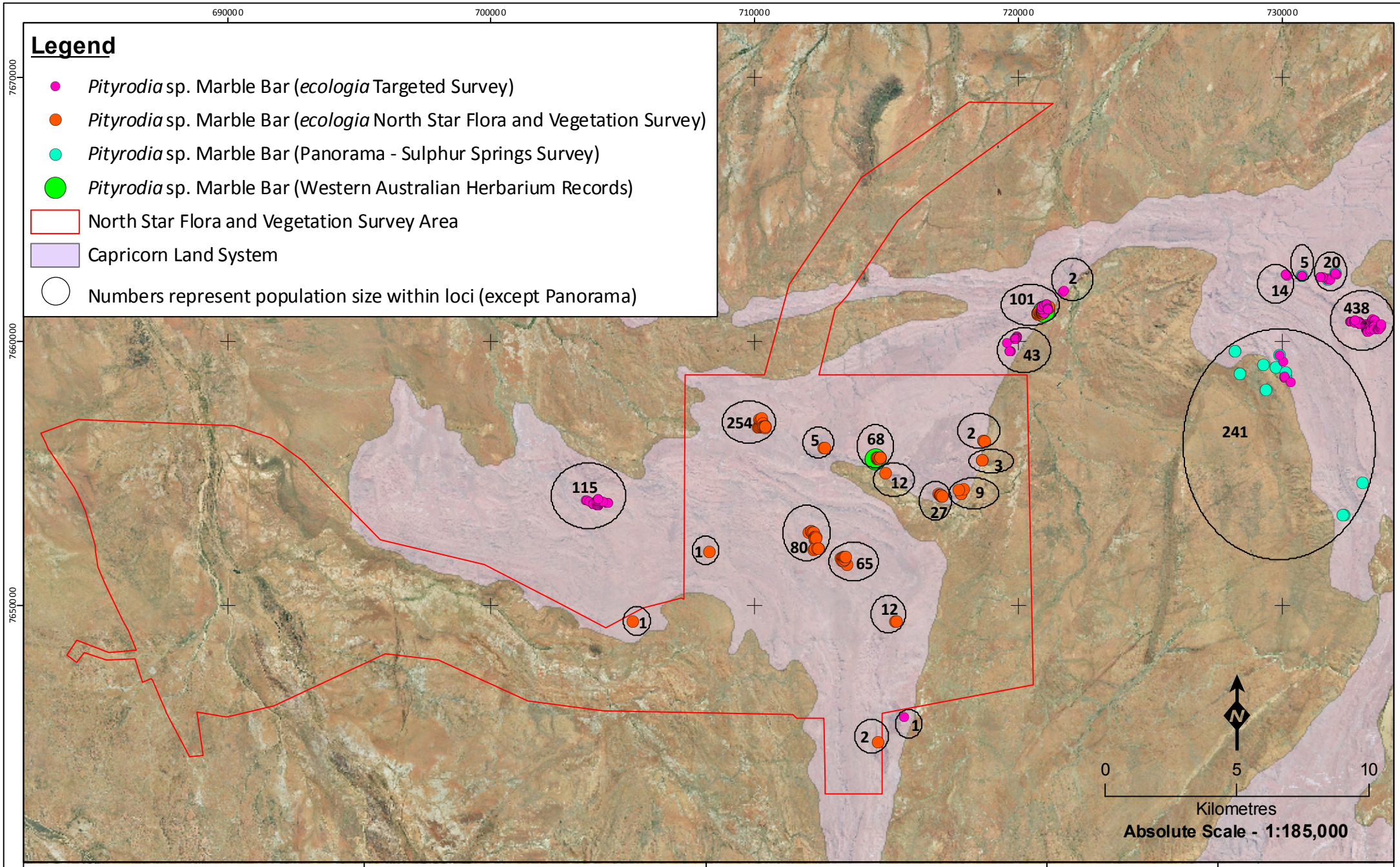
In total, 1521 *Pityrodia* sp. Marble Bar individuals have now been recorded (Table 4.1). Of these 980 (64.4%) occur outside (at 15 loci separated by at least 500 m), and 541 (35.6%) within the North Star flora and vegetation survey area (at 14 loci). Of the individuals outside, 721 occur in the vicinity of the proposed Panorama (Sulphur Springs) project approximately 10 km to the east of North Star and a further 143 individuals are in the vicinity of active exploration being conducted by Atlas Iron as part of the Abydos mine development project, immediately to the north-east of North Star (Figure 4.1).

Of the 541 *Pityrodia* sp. Marble Bar individuals known from within the North Star survey area, 254 (47%) occur at a single locus (Table 4.1), and over 91% of the individuals occur at the 5 most populous loci. The remaining nine loci represent less than 9% of the individuals from within the North Star survey area. Of the 980 *Pityrodia* sp. Marble Bar individuals known from outside the North Star survey area, over 44% are from the single most populous locus.

Some areas, particularly areas of Panorama Station could not be surveyed due to limitations of access. Further potential habitat exists, particularly to the east and south of the locations identified in the Panorama (Sulphur Springs) project (Trudgen *et al.* 2002 cited in; Mattiske 2007), which are inaccessible to vehicles. It is likely that additional locations of *Pityrodia* sp. Marble Bar will be found if these areas are surveyed.

Table 4.1 – All known Loci of *Pityrodia* sp. Marble Bar (separated by > 500 m).

Locus	Inside North Star Survey Area		Outside North Star Survey Area		Data Source
	Number of Locations	Number of Individuals	Number of Locations	Number of Individuals	
1	-	-	53	115	Current survey
2	1	1	-	-	*ecologia* 2012
3	1	1	-	-	*ecologia* 2012
4	15	254	-	-	*ecologia* 2012
5	16	80	-	-	*ecologia* 2012
6	2	5	-	-	*ecologia* 2012
7	13	65	-	-	*ecologia* 2012
8	9	68	-	-	FloraBase and *ecologia* 2012
9	1	2	-	-	*ecologia* 2012
10	1	12	-	-	*ecologia* 2012
11	2	12	-	-	*ecologia* 2012
12	-	-	1	1	Current survey
13	7	27	-	-	*ecologia* 2012
14	3	9	-	-	*ecologia* 2012
15	1	3	-	-	*ecologia* 2012
16	2	2	-	-	*ecologia* 2012
17	-	-	14	43	Current survey
18	-	-	84	101	FloraBase, *ecologia* 2012 and Current survey
19	-	-	2	2	Current survey
20	-	-	3	14	Current survey
21	-	-	3	5	Trudgen *et al.* 2002 and Current survey
22	-	-	13	20	Trudgen *et al.* 2002 and Current survey
23	-	-	220	438	Current survey
24	-	-	1	241	Trudgen *et al.* 2002 and Current survey
25	-	-	1		
26	-	-	1		
27	-	-	12		
28	-	-	2		
29	-	-	1		
Total	14 Loci	541 Individuals	15 Loci	980 Individuals	



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All *Pityrodia* sp. Marble Bar Locations

Figure: 4.1
Project ID: 1416

Drawn: MM
Date: 26/07/2012

Coordinate System
Name: GDA 1994 MGA Zone 50
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5 CONCLUSION

The current survey has resulted in a significant expansion of the known number of plants of this taxon, the majority of which lie beyond the boundaries of the North Star Magnetite Project area. However, all records to date occur within an area approximately 20 km from north to south and 30 km from east to west, and the distribution remains highly localised. Despite searching suitable habitat in all directions around known locations (and up to 75 km in suitable habitat to the east) no substantial extension to this species' range was recorded.

It remains possible that the species is endemic to this area and its current conservation status (Priority 1) is justified.

Some areas, particularly areas of Panorama Station could not be searched due to limitations of access. Further potential habitat exists, particularly to the east and south of the locations identified in the Panorama (Sulphur Springs) project (Trudgen *et al.* 2002 cited in; Mattiske 2007), which are inaccessible to vehicles. It is likely that additional locations of *Pityrodia* sp. Marble Bar will be found if these areas are surveyed.

6 SURVEY TEAM

Licences - "Licence to Take Flora for Scientific Purposes"		
This targeted flora survey was conducted under the authorisation of the following licences issued by the DEC:		
	Permit Number	**Valid Until**
Matthew Macdonald	SL009453 SL009996	30th April 2012 30th April 2013
Mariana Campos	SL009608 SL009995	30th April 2012 30th April 2013
Kaisan Critchell	SL009497 SL009993	30th April 2012 30th April 2013

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APPENDIX A CONSERVATION CATEGORIES

Table D.4 – Definition of Threatened and Priority Flora Categories under the *WC Act*.

Conservation Code	Definition
T: Threatened Flora (Declared Rare Flora — Extant)	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 (Schedule 1 of the Wildlife Conservation (Rare Flora) Notice under the Wildlife Conservation Act 1950). Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria: • CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild • EN: Endangered – considered to be facing a very high risk of extinction in the wild • VU: Vulnerable – considered to be facing a high risk of extinction in the wild.
X: Presumed Extinct Flora (Declared Rare Flora — Extinct)	Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 of the Wildlife Conservation (Rare Flora) Notice under the Wildlife Conservation Act 1950).
P1: Priority One: Poorly-known taxa	Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2: Priority Two: Poorly-known taxa	Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3: Priority Three: Poorly-known taxa	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4: Priority Four: Rare, Near Threatened and other taxa in need of monitoring	1. 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. **Rare**. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. 2. **Near Threatened**. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. 3. Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5: Priority Five: Conservation Dependent taxa	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

APPENDIX B PREVIOUSLY KNOWN *PITYRODIA* SP. MARBLE BAR LOCATIONS

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APPENDIX C NEW *PITYRODIA* SP. MARBLE BAR LOCATIONS

APPENDIX D THREATENED AND PRIORITY FLORA REPORT FORMS