

# TARGETED FLORA & VEGETATION SURVEY IRON BRIDGE

PREPARED FOR: IRON BRIDGE OPERATIONS



**Spectrum  
ECOLOGY**



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## TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	1
1. INTRODUCTION.....	3
1.1. PROJECT BACKGROUND.....	3
1.2. OBJECTIVES.....	3
1.3. DESKTOP ASSESSMENT.....	5
1.3.1. Likelihood of Occurrence Assessment.....	5
1.3.2. Significant Flora.....	6
1.3.3. Significant Vegetation.....	6
2. METHODS.....	11
2.1. LEGISLATION & GUIDELINES.....	11
2.2. PERSONNEL & LICENCES.....	11
2.3. SURVEY TIMING.....	11
2.4. FIELD METHODS.....	12
2.4.1. Sampling Effort.....	12
2.4.2. Traverses.....	12
2.4.3. Recording Significant Flora & Vegetation.....	12
2.4.4. <i>Quoya zonalis</i> .....	13
2.4.5. Vegetation Condition Mapping.....	14
2.5. SURVEY LIMITATIONS.....	14
3. RESULTS.....	16
3.1. SIGNIFICANT FLORA.....	16
3.2. SIGNIFICANT VEGETATION.....	16
3.3. VEGETATION CONDITION OF SLURRY CORRIDOR.....	26
3.3.1. Introduced Flora.....	26
4. DISCUSSION.....	28
4.1. POST SURVEY LIKELIHOOD OF OCCURRENCE OF THREATENED & PRIORITY 1 TAXA.....	28
4.1.1. <i>Quoya zonalis</i> .....	28
4.1.2. <i>Acacia cyperophylla</i> var. <i>omearana</i> .....	28
4.1.3. <i>Acacia leeuweniana</i> .....	28
4.1.4. <i>Heliotropium parviantrum</i> .....	29
4.1.5. <i>Josephinia</i> sp. Woodstock (A.A. Mitchell PRP 989).....	29
4.1.6. <i>Tephrosia rosea</i> var. Port Hedland (A.S. George 1114).....	29
5. CONCLUSION.....	30
6. REFERENCES.....	31

## TABLES

Table 1.1: Desktop Assessment Sources.....	5
Table 1.2: Likelihood of Occurrence Assessment Criteria.....	5
Table 1.3: Desktop Assessment – Distance to Survey Area (km) & Pre-survey Likelihood of Occurrence.....	7
Table 2.1: Personnel & Licences.....	11
Table 2.2: Target Species Flowering & Detectability.....	11

Table 2.3: Vegetation Condition Scale & Criteria .....	14
Table 2.4: Limitations & Constraints .....	14
Table 3.1: Significant Flora.....	17
Table 3.2: Vegetation Condition at the Slurry Corridor South Survey Area .....	26
Table 3.3: Introduced Flora Recorded at the Slurry Corridor South Survey Area .....	26

## MAPS

Map 1.1: Survey Areas - Overview .....	4
Map 1.2: Desktop Assessment – Threatened & P1 Significant Flora.....	9
Map 1.3: Desktop Assessment – P1 to P4 Significant Flora.....	10
Map 3.1: Significant Flora & Traverses – Aerodrome & Infrastructure Corridor.....	18
Map 3.2: Significant Flora & Traverses – S45c Slurry Corridor North.....	19
Map 3.3: Significant Flora & Traverses – S45c Slurry Corridor South.....	20
Map 3.4: Significant Flora & Traverses – S45c Water Corridor Camp North.....	21
Map 3.5: Significant Flora & Traverses – S45c Water Corridor Camp South.....	22
Map 3.6: Significant Flora & Traverses – S45c Water Corridor North.....	23
Map 3.7: Significant Flora & Traverses – Water Corridor Re-Survey Area – South A .....	24
Map 3.8: Significant Flora & Traverses – Water Corridor Re-Survey Area – South B.....	25
Map 3.9: Vegetation Condition & Introduced Flora at the Slurry Corridor South .....	27

## APPENDICES

Appendix A: Conservation Codes & Significant Definitions .....	32
Appendix B: Likelihood of Occurrence Assessment.....	36

## EXECUTIVE SUMMARY

Iron Bridge Operations Pty Ltd (IBO) continue to develop the iron ore mining operations located at North Star in the Pilbara region of Western Australia (WA). The North Star project is located approximately 110 km south of Port Hedland and approximately 20 km to the east of the Fortescue rail line. The North Star (Stage 2 – Magnetite) project comprises a mining area, slurry pipeline, infrastructure corridor, and the Canning Basin borefield and water corridor.

A targeted flora survey was required in order to satisfy the requirements of the *North Star Significant Flora & Vegetation Survey Plan (NS-PL-EN-005)* to identify all Threatened and Priority 1 flora taxa and Threatened Ecological Communities (TEC) within the aforementioned project areas to ensure environmental risks are minimised.

IBO engaged Spectrum Ecology to undertake a targeted flora survey at the Aerodrome, Infrastructure Corridor (IC), Slurry Corridor (SC; North, South), Water Corridor (WC) S45c additional areas (Camp North, Camp South, North), and the Water Corridor Re-survey high priority areas (North, South). In addition, the vegetation condition of the Slurry Corridor South Survey Area was assessed.

The targeted survey was undertaken over 48 person days between 22 October and 2 November 2020 by four experienced botanists, during which approximately 440 km of traverses were surveyed. In addition, notes were taken in order to map the vegetation condition of the SC South Survey Area.

One Threatened and 11 Priority 1 taxa were identified during the desktop assessment as occurring within 80 km of the Survey Areas. Three taxa were assigned a High likelihood and five were assigned a Medium likelihood of occurrence within the Survey Areas:

Pre-survey High Likelihood:

- T – *Quoya zonalis*: WC North, WC Camp North, WC Camp South, WC Re-survey South, Aerodrome;
- P1 – *Heliotropium parviantrum*: WC Re-survey North; and
- P1 – *Tephrosia rosea* var. Port Hedland (A.S. George 1114): SC North.

Pre-survey Medium Likelihood:

- T – *Quoya zonalis*: SC South, WC Re-survey North;
- P1 – *Acacia cyperophylla* var. *omearana*: WC Re-survey North;
- P1 – *Acacia leeuweniana*: SC South;
- P1 – *Josephinia* sp. Woodstock (A.A. Mitchell PRP 989): IC, Aerodrome; and
- P1 – *Tephrosia rosea* var. Port Hedland (A.S. George 1114): WC Re-survey North.

Three significant flora taxa were recorded during the field assessment:

- Threatened: *Quoya zonalis*;
- Priority 3: *Heliotropium muticum*; and
- Priority 4: *Ptilotus mollis*.

*Quoya zonalis* (Threatened) was often recorded as groups of plants and was commonly recorded throughout the WC Camp North, WC Camp South, WC North, and Water Corridor South Re-Survey Area. It was recorded on rocky hillslopes high in the landscape, especially on mesa edges and gullies. There were 2,812 individuals of *Quoya zonalis* recorded in total across the Survey Areas.



One Priority 3 taxon, *Heliotropium muticum*, was recorded as scattered individuals within the SC North and South areas. It was recorded on sandy granitic plains, and often in areas that had been recently burnt. There were 122 individuals of *Heliotropium muticum* recorded in total across the Survey Areas.

One Priority 4 taxon, *Ptilotus mollis* was recorded as large clumps of individuals within the WC Camp North, WC Camp South, and WC North areas. It was recorded on steep ironstone upper slopes. There were 92 individuals of *Ptilotus mollis* recorded in total across the Survey Areas.

Of the Threatened and Priority flora recorded during the desktop assessment, two species were considered to have a Medium likelihood of occurrence or higher following the field survey:

*Quoya zonalis* (Threatened) was the only Threatened or Priority 1 flora taxon recorded during the survey. This taxon was recorded in large numbers across the WC North, WC Camp North, WC Camp South, and WC Re-survey South. Following the survey, it was considered to have a Low likelihood of occurrence in the remaining Survey Areas. In the WC North Survey Area there may be more individuals present than what was recorded, however the population extent has been mapped.

*Tephrosia rosea* var. Port Hedland (A.S. George 1114) was assigned a High likelihood of occurrence in the SC North Survey Area. However, following the survey, it has been assigned a Medium likelihood of occurrence in the disturbed areas that could not be visually inspected. It is not considered to occur in the remaining areas.

*Josephinia* sp. Woodstock (A.A. Mitchell PRP 989) was assigned a Medium likelihood of occurrence pre survey as a precautionary measure due to the unknown nature of the perenniality of the species and unknown presence because of survey timing. However, it is considered unlikely that the species occurs in this location, since the closest records of the species are greater than 30 km south of the development envelopes, the species has not been recorded north of these records, and the species has not been recorded in any target flora surveys in immediately adjacent area

All other Priority 1 taxa have been assigned a Low likelihood of occurrence in the Survey Areas following the field survey. No other significant flora as defined by EPA (2016a) were recorded in the survey.

# 1. INTRODUCTION

## 1.1. Project Background

Iron Bridge Operations Pty Ltd (IBO) continue to develop iron ore mining operations located at North Star in the Pilbara region of Western Australia (WA). IBO is a majority-owned subsidiary of Fortescue Metals Group Ltd (Fortescue), which owns and operates mining and infrastructure projects in the Pilbara.

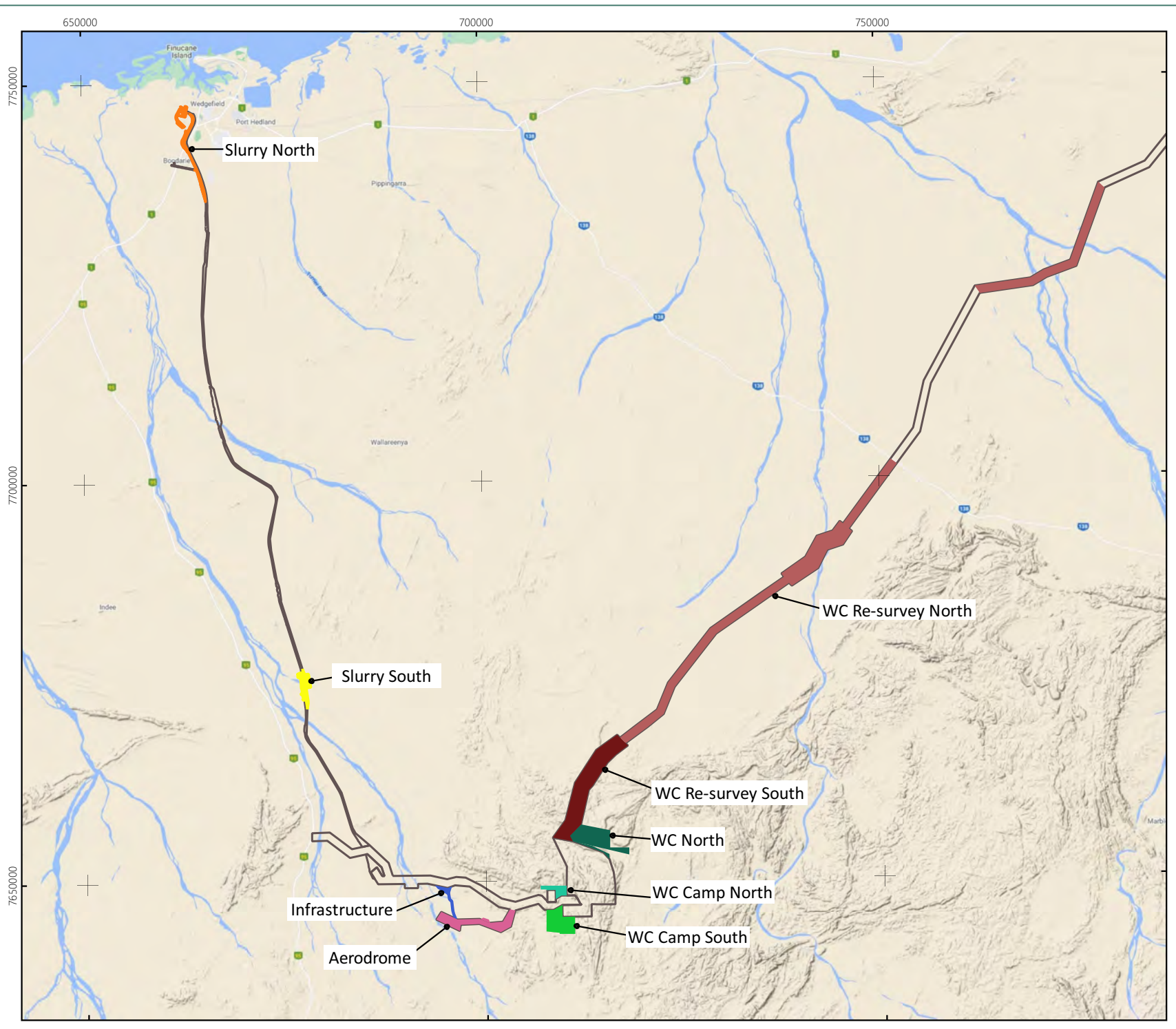
The North Star project is located approximately 110 km south of Port Hedland and approximately 20 km to the east of the Fortescue rail line. The North Star (Stage 2 – magnetite) project is approved under Ministerial Statement 993 and comprises a mining area, slurry pipeline, infrastructure corridor, and the Canning Basin borefield and water corridor.

## 1.2. Objectives

The targeted flora survey was undertaken in order to satisfy the conditions of the *North Star Significant Flora & Vegetation Survey Plan (NS-PL-EN-005)* to identify all Threatened and Priority 1 flora taxa, and Threatened Ecological Communities (TEC) within the Survey Areas to ensure risks are minimised (see Appendix A for conservation category definitions).

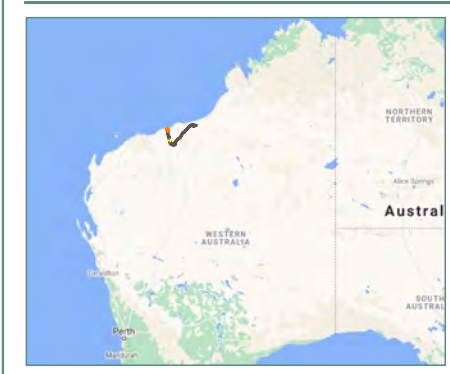
The targeted flora survey was conducted at the following Survey Areas (Map 1.1):

- Aerodrome (1,500 ha);
- Infrastructure Corridor (IC) additional S45c area (238.9 ha);
- Slurry Corridor (SC) additional S45c areas:
  - SC North (332.4 ha); and
  - SC South (274.4 ha).
- Water Corridor (WC) additional S45c areas:
  - WC Camp North (281.2 ha);
  - WC Camp South (936.2 ha); and
  - WC North (1,313.1 ha).
- Water Corridor Re-survey high priority areas:
  - North (8,361.1 ha); and
  - South (2,950.9 ha).



### Legend

- Survey Areas
- Aerodrome
- Infrastructure Corridor
- Slurry Corridor North
- Slurry Corridor South
- Water Corridor Camp North
- Water Corridor Camp South
- Water Corridor North
- Water Corridor Re-survey North
- Water Corridor Re-survey South
- Development Envelopes



0      10      20 km  
 Scale 1:700,000      @ A4  
Coordinate System: GDA 1994 MGA Zone 50  
 Projection: Transverse Mercator  
 Units: Meter

Author: Melissa Hay      Date: 18-11-2020

## Survey Areas - Overview

Targeted Flora & Vegetation Survey,  
Iron Bridge



### 1.3. Desktop Assessment

Since the development of the North Star Significant Flora & Vegetation Survey Plan in 2014, the conservation status of many of the flora species has changed, along with additional species being listed. A desktop assessment was therefore undertaken prior to undertaking the field survey to ensure the currency of the target flora species and that the assessment met the requirements of the survey plan. Sources incorporated into the desktop assessment are listed in Table 1.1.

**Table 1.1: Desktop Assessment Sources**

Data Source	Custodian	Details
Australasian Virtual Herbarium	Council of Heads of Australasian Herbaria (CHAH)	Date: 14/10/2020
Commonwealth Protected Matter Search Tool (PMST)	Department of the Environment and Energy (DoEE)	Date: 15/10/2020 Buffer: 20 km
NatureMap	Department of Parks and Wildlife (DPaW)	Date: 14/10/2020, Buffer: 30 km, Centre Points: 118° 56' 47" E, 21° 14' 32" S 118° 33' 47" E, 20° 23' 04" S 118° 41' 06" E, 21° 01' 31" S
Threatened & Priority flora database (WAH/TPFL)	DBCA	Date: 15/10/2020; Buffer: 80 km; Reference: 35-01020FL
Index of Biodiversity Surveys of Assessments (IBSA) database.	Department of Water and Environmental Regulation (DWER)	Date: 14/10/2020, Buffer: 30 km
Fortescue Database	Fortescue Metals Group (Fortescue)	12/10/2020
Ecologia (2016) Water Corridor Targeted Flora Survey	Fortescue Metals Group (Fortescue)	08/07/2016

#### 1.3.1. Likelihood of Occurrence Assessment

The following information was collated for each significant flora taxon or vegetation community identified during the desktop assessment:

- Taxon/community name;
- Conservation status (EPBC Act, WC Act, DBCA listing);
- Description of taxon/community and lifeform;
- Longevity category (annual/perennial) and flowering period (flora);
- Description of habitat requirements;
- Source of record (DBCA, previous report etc.); and
- Distance of record from the Survey Area.

A likelihood of occurrence assessment was then conducted using the criteria listed in Table 1.2. This involved using the distance of the record from the Survey Area and the presence of appropriate habitat within based on land systems, geology, vegetation mapping, and/or aerial imagery. Historical records considered not accurate were excluded as required.

**Table 1.2: Likelihood of Occurrence Assessment Criteria**

Likelihood	Flora & Vegetation
Recorded	Species or community accurately recorded within during the desktop assessment, including TEC/PEC buffers that intersect.
High	Species or community recorded in close proximity, and suitable habitat does, or is likely to occur.
Medium	Species or community recorded outside but within 20 km and suitable habitat may occur.

Likelihood	Flora & Vegetation
Low	Species or community rarely or not recorded within 20 km and suitable habitat does not likely occur within.

Where taxa had previously been recorded within the survey plan, the survey priority listed was utilised, rather than based on the criteria discussed. These have been indicated with a ^ in the following sections.

### 1.3.2. Significant Flora

One Threatened and 11 Priority 1 taxa were identified during the desktop assessment as occurring within 80 km of the Survey Areas. These are listed in Table 1.3 along with the distance to each Survey Area and the pre-survey likelihood of occurrence, and they are mapped in Map 1.2 to Map 1.3. The full likelihood of occurrence assessment is presented in Appendix B. Three taxa were assigned a High, five were assigned a Medium, and seven were assigned a Low likelihood of occurrence within the Survey Areas:

#### Pre-survey High Likelihood:

- T – *Quoya zonalis*: WC north, WC Camp North, WC Camp South, WC Re-survey South, Aerodrome;
- P1 – *Heliotropium parviantrum*: WC Re-survey North<sup>^</sup>; and
- P1 – *Tephrosia rosea* var. Port Hedland (A.S. George 1114): SC North.

#### Pre-survey Medium Likelihood:

- T – *Quoya zonalis*: SC South, WC Re-survey North<sup>^</sup>;
- P1 – *Acacia cyperophylla* var. *omearana*: WC Re-survey North;
- P1 – *Acacia leeuweniana*: SC South;
- P1 – *Josephinia* sp. Woodstock (A.A. Mitchell PRP 989): IC, Aerodrome; and
- P1 – *Tephrosia rosea* var. Port Hedland (A.S. George 1114): WC Re-survey North<sup>^</sup>.

#### Pre-survey Low Likelihood:

- P1 – *Acacia* sp. Marble Bar (J.G. & M.H. Simmons 3499);
- P1 – *Atriplex eremitis*;
- P1 – *Cochlospermum macnamarae*;
- P1 – *Corchorus* sp. Yarrie (J. Bull & D. Roberts CAL 01.05);
- P1 – *Fimbristylis* sp. Shay Gap (K.R. Newbey 10293);
- P1 – *Heliotropium parviantrum*; and
- P1 – *Schoenus coultasii*.

Two additional Priority 2, 21 Priority 3, and four Priority 4 flora taxa were also recorded and are included in Table 1.3. The North Star Significant Flora & Vegetation Survey Plan also identified *Eriachne melicacea*, a range extension (as per EPA 2016a), as potentially occurring. *Eriachne melicacea* is no longer considered a range extension based on Florabase data (2021) with three records surrounding the Survey Areas. No other significant flora taxa (as per EPA 2016a) are known from the Survey Areas. One Threatened taxon, *Seringia exastia*, was recorded during the desktop assessment as occurring within 7 km of the Slurry Corridor North Survey Area. This Threatened taxon has recently undergone a taxonomic revision and was combined with *Seringia elliptica*, a widespread Pilbara taxon, and a nomination to delist is underway.

### 1.3.3. Significant Vegetation

One Threatened Ecological Community (TEC) associated with flora and vegetation is known from the Pilbara region ('Themeda grasslands on cracking clay'). This has been assigned a Low likelihood of occurrence at the Survey Areas due to the lack of suitable cracking clay habitat within any of the Survey Areas.

Table 1.3: Desktop Assessment – Distance to Survey Area (km) &amp; Pre-survey Likelihood of Occurrence

Status	Species	Aerodrome	IC	SC North	SC South	WC Camp North	WC Camp South	WC North	WC Re-survey North	WC Re-survey South
<b>Threatened &amp; Priority 1</b>										
T (EN/EN)	<i>Quoya zonalis</i>	3	9	>50	30^	1	0	0	10	0
P1	<i>Acacia cyperophylla</i> var. <i>omearana</i>	>50	>50	>50	>50	>50	>50	>50	15	48
P1	<i>Acacia leeuweniana</i>	8	9	>50	27	21	21	26	40	24
P1	<i>Acacia</i> sp. Marble Bar (J.G. & M.H. Simmons 3499)	>50	>50	>50	>50	>50	>50	>50	>50	>50
P1	<i>Atriplex eremitis</i>	>50	>50	48	>50	>50	>50	>50	>50	>50
P1	<i>Cochlospermum macnamarae</i>	>50	>50	>50	>50	>50	>50	>50	>50	>50
P1	<i>Corchorus</i> sp. Yarrie (J. Bull & D. Roberts CAL 01.05)	>50	>50	>50	>50	>50	>50	43	14	35
P1	<i>Fimbristylis</i> sp. Shay Gap (K.R. Newbey 10293)	>50	>50	>50	>50	>50	>50	>50	>50	>50
P1	<i>Heliotropium parviantrum</i>	>50	>50	>50	>50	>50	>50	>50	45*^	>50
P1	<i>Josephinia</i> sp. Woodstock (A.A. Mitchell PRP 989)	31	33	>50	>50	35	30	42	>50	42
P1	<i>Schoenus coultasii</i>	>50	>50	>50	>50	>50	>50	>50	>50	>50
P1	<i>Tephrosia rosea</i> var. Port Hedland (A.S. George 1114)	>50^	>50^	0	>50	>50	>50	>50	>50^	>50
<b>Priority 2 to Priority 4</b>										
P2	<i>Euphorbia inappendiculata</i> var. <i>inappendiculata</i>	47	>50	>50	>50	39	42	28	9	22
P2	<i>Gomphrena pusilla</i>	>50	>50	5	>50	>50	>50	>50	>50	>50
P3	<i>Abutilon</i> sp. Pritzelianum (S. van Leeuwen 5095)	5*^	4*^	9	23^	5*^	5*^	5*^	10^	10^
P3	<i>Acacia levata</i>	19	20	>50	35	32	30	39	49	38
P3	<i>Eragrostis crateriformis</i>	1	2	5	6	20	12	20	0	24
P3	<i>Euphorbia clementii</i>	5	4	46	10	8	7	13	0	28
P3	<i>Fimbristylis sieberiana</i>	10	15	>50	46	12	10	18	32	20
P3	<i>Gomphrena cucullata</i>	>50	>50	>50	>50	>50	>50	>50	>50	>50
P3	<i>Gomphrena leptophylla</i>	14	12	6	6	23	25	27	36	25
P3	<i>Gymnanthera cunninghamii</i>	10	8	4	1	20	22	25	35	23
P3	<i>Heliotropium murinum</i>	35	37	>50	>50	38	34	33	0	40
P3	<i>Heliotropium muticum</i>	12	9	8	2	20	22	17	0	7
P3	<i>Nicotiana umbratica</i>	11	9	>50	7	22	20	25	34	26
P3	<i>Oldenlandia</i> sp. Hamersley Station (A.A. Mitchell PRP 1479)	46	>50	>50	>50	38	40	31	10	22
P3	<i>Phyllanthus hebecarpus</i>	10	7	>50	22	21	22	24	36	22

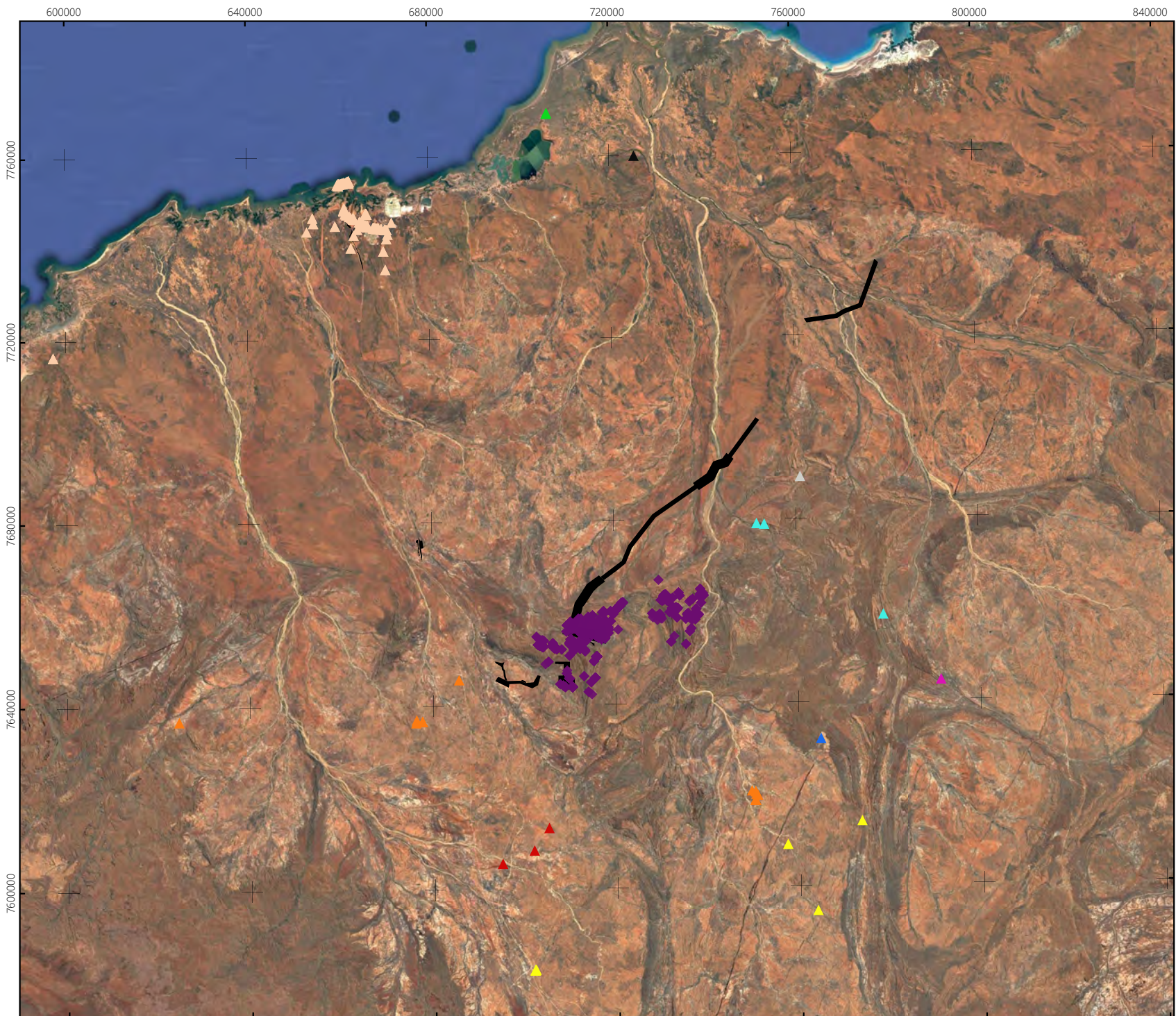
Status	Species	Aerodrome	IC	SC North	SC South	WC Camp North	WC Camp South	WC North	WC Re-survey North	WC Re-survey South
P3	<i>Rostellularia adscendens</i> var. <i>latifolia</i>	>50	>50	>50	>50	>50	>50	>50	>50	>50
P3	<i>Rothia indica</i> subsp. <i>australis</i>	46	42	13	11	37*	33*	46*	10*	46*
P3	<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	>50	>50	18	>50	>50	>50	>50	>50	>50
P3	<i>Stylidium weeliwolli</i>	7	8	>50	7	19	20	25	38	23
P3	<i>Terminalia supranitifolia</i>	17	13	>50	15	22	24	23	28	20
P3	<i>Triodia basitricha</i>	23	27	>50	44	17	19	9	7	7
P3	<i>Triodia chichesterensis</i>	5	7	32	1	12	9	19	10	24
P3	<i>Vigna triodiophila</i>	24	22	>50	14	35	35	38	45	36
P4	<i>Bulbostylis burbridgeae</i>	9	10	0	4	22	19	33	20	24
P4	<i>Goodenia nuda</i>	30	27	3	3	37	38	35	41	37
P4	<i>Ptilotus mollis</i>	10	18	27	40	5	3	8	20	9
P4	<i>Rhynchosia bungarensis</i>	>50	>50	>50	>50	>50	>50	>50	>50	>50

Red = High, Yellow = Medium, Green = Low likelihood of occurrence, IC = Infrastructure Corridor, SC = Slurry Corridor, WC = Water Corridor.

^ = plan rating utilised rather than method in Table 1.2.

\* = distance calculated from records mapped in plan as coordinates not available.





## Legend

■ Survey Areas

### Threatened

◆ Quoya zonalis

### Priority 1

▲ Acacia cyperophylla var. omearana

▲ Acacia leeuweniana

▲ Acacia sp. Marble Bar (J.G. & M.H. Simmons 3499)

▲ Atriplex eremitis

▲ Cochlospermum macnamarae

▲ Corchorus sp. Yarrie (J. Bull & D. Roberts CAL 01.05)

▲ Heliotropium parviantrum

▲ Josephinia sp. Woodstock (A.A. Mitchell PRP 989)

▲ Schoenus coultsii

▲ Tephrosia rosea var. Port Hedland (A.S. George 1114)



0 20 40 km  
Scale 1:1232365 @ A4

Coordinate System: GDA 1994 MGA Zone 50  
Projection: Transverse Mercator  
Units: Meter



Author: Melissa Hay

Date: 13-11-2020

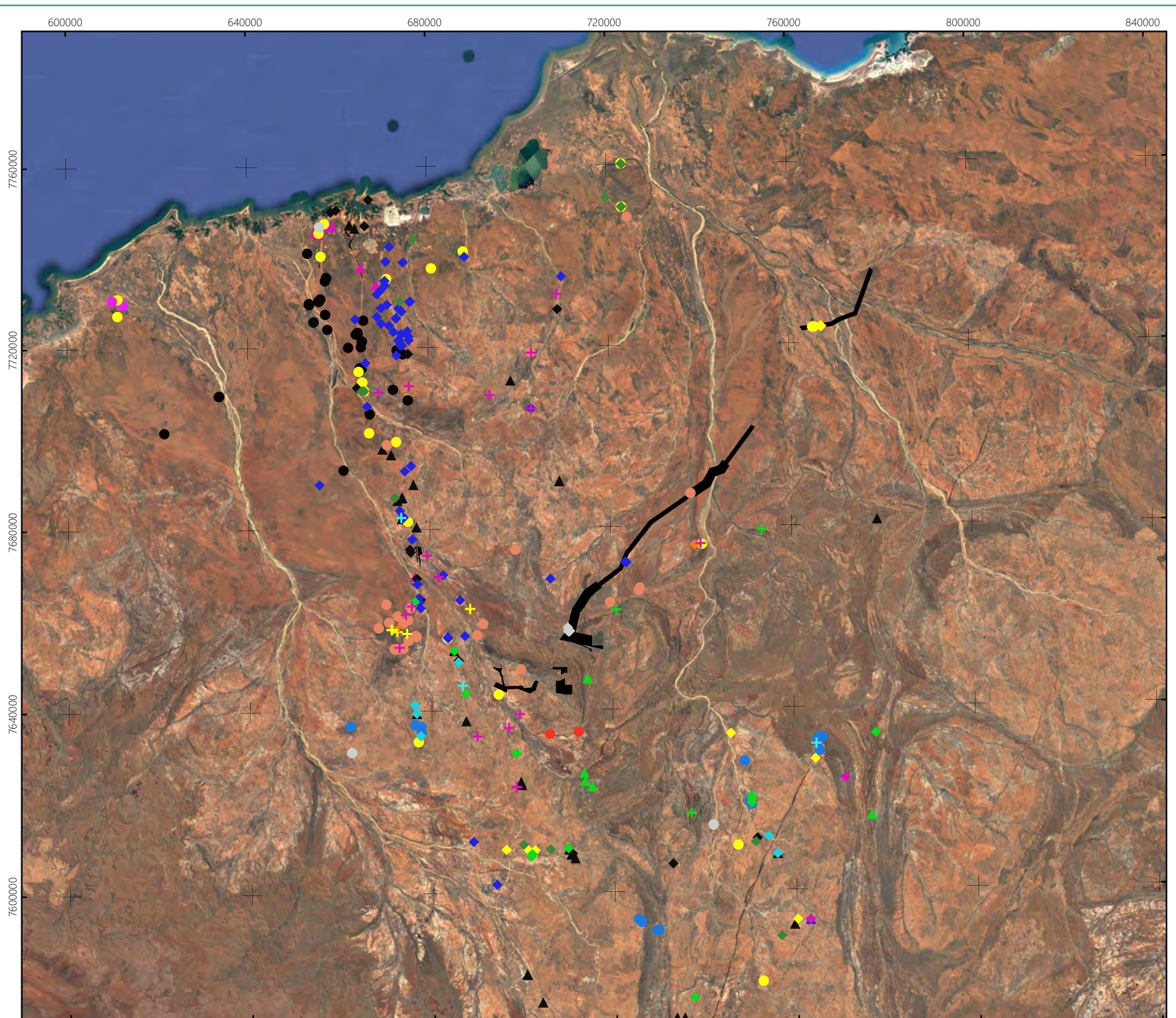
## Desktop Assessment Threatened & P1 Significant Flora

Targeted Flora & Vegetation Survey, Iron Bridge

Prepared for  
Iron Bridge

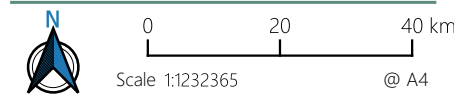
MAP  
1.2





## Legend

- Survey Areas
- Priority 2**
- ◆ *Euphorbia inappendiculata* var. *inappendiculata*
- *Gomphrena pusilla*
- Priority 3**
- *Abutilon* sp. *Pritzelianum* (S. van Leeuwen 5095)
- *Acacia levata*
- *Eragrostis crateriformis*
- *Euphorbia clementii*
- *Fimbristylis sieberiana*
- *Gomphrena cucullata*
- *Gomphrena leptophylla*
- ◆ *Gymnanthera cunninghamii*
- ◆ *Heliotropium murinum*
- ◆ *Heliotropium muticum*
- ◆ *Nicotiana umbratica*
- ◆ *Oldenlandia* sp. *Hammersley Station* (A.A. Mitchell PRP)
- ◆ *Phyllanthus hebecarpus*
- ◆ *Quoya zonalis*
- ◆ *Rostellularia adscendens* var. *latifolia*
- ◆ *Rothia indica* subsp. *australis*
- ◆ *Sida* sp. *Barlee Range* (S. van Leeuwen 1642)
- ◆ *Stylidium weeliwollii*
- ◆ *Terminalia supranitifolia*
- ◆ *Triodia basitricha*
- ◆ *Triodia chichesterensis*
- ◆ *Vigna tridiophila*
- Priority 4**
- ▲ *Bulbostylis burbidgeae*
- ▲ *Goodenia nuda*
- ▲ *Ptilotus mollis*
- ▲ *Rhynchosia bungarensis*



Coordinate System: GDA 1994 MGA Zone 50  
 Projection: Transverse Mercator  
 Units: Meter



Author: Melissa Hay Date: 13-11-2020

## Desktop Assessment P2 to P4 Significant Flora

Targeted Flora & Vegetation Survey, Iron Bridge

Prepared for  
Iron Bridge

MAP  
1.3



## 2. METHODS

### 2.1. Legislation & Guidelines

Flora and vegetation in Western Australia are protected by various legislation, including:

- The State *Biodiversity Conservation Act 2016* (BC Act);
- The Commonwealth *Environmental Protection Act 1986* (EP Act); and
- The Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This assessment is compliant with the appropriate guidelines as outlined in:

- The EPA Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b); and
- The North Star Significant Flora & Vegetation Survey Plan (NS-PL-EN-005) (the survey plan).

### 2.2. Personnel & Licences

Spectrum Ecology staff involved with this assessment are listed in Table 2.1, along with their project involvement, years of experience, and relevant licenses.

**Table 2.1: Personnel & Licences**

Personnel	Role	Project Involvement	Experience	Flora Licence
Melissa Hay	Principal Botanist	Project management, field assessment, reporting, report review	12 years	FB62000006-2
Carmel Winton	Senior Botanist	Report review, plant identification	5 years	-
Dr. Tim Hammer	Senior Botanist & Taxonomist	Field assessment, plant identification	5 years	FB62000124
Dr. Chris Shaw	Botanist	Field assessment, data analysis, reporting	3 years	FB62000241
Susan Murrey	Botanist	Field assessment	2 years	FB62000101-1b

### 2.3. Survey Timing

The targeted survey was undertaken from the 22 October to 2 November 2020 over 48 person days. The ideal timing for undertaking a flora survey in the Pilbara IBRA region is six to eight weeks following summer rainfall (March to May). The field survey therefore occurred in less optimal conditions for plant growth and flowering times for the region, however as the assessment was a targeted survey, appropriate survey timing is associated with being able to detect and identify the target species. Table 2.2 lists the Threatened and P1 target species, their longevity, flowering period, identifiability, and detectability during the current survey.

**Table 2.2: Target Species Flowering & Detectability**

Status	Taxon	Longevity & Lifeform	Flowering Period	ID from Vegetative Material	Highest Likelihood of Occurrence	Detectability in Survey
T	<i>Quoya zonalis</i>	Perennial shrub	July to Aug	Yes	High	Yes
P1	<i>Acacia cyperophylla</i> var. <i>omearana</i>	Perennial shrub	March to April	Yes	Medium	Yes
P1	<i>Acacia leeuweniana</i>	Perennial shrub	April to May, Oct	Yes	Medium	Yes
P1	<i>Acacia</i> sp. Marble Bar (J.G. & M.H. Simmons 3499)	Perennial shrub	Sep	Yes	Low	Yes
P1	<i>Atriplex eremitis</i>	Perennial shrub	Aug	Yes	Low	Yes
P1	<i>Cochlospermum macnamarae</i>	Perennial shrub	Unknown	Yes	Low	Yes
P1	<i>Corchorus</i> sp. Yarrie (J. Bull & D. Roberts CAL 01.05)	Perennial shrub	Unknown	Unknown	Low	Yes
P1	<i>Fimbristylis</i> sp. Shay Gap (K.R. Newbey 10293)	Annual herb	June to July	No	Low	No

Status	Taxon	Longevity & Lifeform	Flowering Period	ID from Vegetative Material	Highest Likelihood of Occurrence	Detectability in Survey
P1	<i>Heliotropium parviantrum</i>	Annual herb	Feb to June	No	High <sup>1</sup>	No
P1	<i>Josephinia</i> sp. Woodstock (A.A. Mitchell PRP 989)	Perennial herb	Unknown	Unknown	Medium <sup>2</sup>	Unknown
P1	<i>Schoenus coultasii</i>	Annual sedge	May?	No	Low	No
P1	<i>Tephrosia rosea</i> var. Port Hedland (A.S. George 1114)	Perennial shrub	July to Sept	Yes	High	Yes

Of the twelve target species, one was an annual and one was a short-lived perennial that may not be present due to the survey timing and were assigned a medium or higher likelihood of occurrence.

<sup>1</sup>*Heliotropium parviantrum*, was assigned a high priority for survey in the survey plan, however in the updated desktop assessment, the closest record to the Survey Area was more than 50 km, and it was considered unlikely to occur. This high priority area was traversed by Ecologia in 2016 during the appropriate season and the species was not recorded.

<sup>2</sup>*Josephinia* sp. Woodstock (A.A. Mitchell PRP 989) was assigned a Medium likelihood of occurrence within the Infrastructure and Aerodrome Survey Areas. As a perennial herb, it may be present during the current assessment depending on the perenniality of the species. Appropriate habitat was searched in these areas during the current assessment.

## 2.4. Field Methods

### 2.4.1. Sampling Effort

The field assessment was undertaken by conducting traverses across the Survey Areas in accordance with the survey plan. A total of 440 km of traverses were undertaken across the Survey Areas. The traverses have been mapped on Map 3.1 to Map 3.8. No traverses were undertaken at the WC Re-survey North Area as it was considered unlikely to contain any Threatened or Priority 1 species.

### 2.4.2. Traverses

Traverses were linear where the terrain allowed (i.e. flat areas), with the botanist detouring from a straight line in order to investigate plants or areas of habitat of particular interest (e.g. area of disturbance for plants that may be disturbance opportunists, drainage lines, rock piles etc.), before returning, in a forward trajectory. Where the terrain was difficult to traverse (i.e. steep hills, cliffs, and gullies), the traverses generally followed the safest path which was often the ridge top, or the gully base.

Traverse spacing was undertaken at an appropriate distance for each area (i.e. areas with a High likelihood of recording the target species were traversed at a spacing in order to record all individuals present). The maximum spacing between traverses was 500 m and this was only undertaken in areas considered to have a Low likelihood of occurrence of target species.

### 2.4.3. Recording Significant Flora & Vegetation

When Threatened or Priority 1 flora taxa were encountered, the survey intensity surrounding that point was increased to search for additional individuals and to delineate the population. When other significant flora taxa were encountered, (i.e. Priority 2 to Priority 4, and other significant flora as defined by EPA (2016a)), they were opportunistically recorded along the traverse.

Threatened taxa were recorded at an individual plant level where possible (i.e. a GPS co-ordinate for each plant). Priority 1 species were recorded as a population estimate and extent, with every sub-population, (i.e.

discrete group of plants), recorded as a GPS co-ordinate and a count or estimation of individual plants. When significant flora were encountered sufficient information was collected to be compliant with the requirements of the Threatened and Priority flora report form, and included:

- Taxon, conservation status;
- Observation date;
- Observer, role, organisation;
- Description of location, land tenure;
- GPS coordinates;
- Abundance count; count method;
- Reproductive state (of collected specimens);
- Condition of population;
- Habitat information;
- Vegetation classification; and
- Condition of habitat, fire history etc.

Whilst undertaking the traverses, vegetation was recorded as opportunistically encountered if it was considered to have similar features to the known TEC of the Pilbara.

#### 2.4.4. *Quoya zonalis*

*Quoya zonalis* (Threatened) was recorded on steep upper slopes, ridges, and gullies. Because of its light white/grey appearance and growth on bare rocky outcrops, it was clearly seen from a distance of up to 100 to 150 m in most areas (Plate 2.1). Traverses conducted in areas targeting *Quoya zonalis* were restricted to where the botanists could safely walk and therefore the spacing was approximately 200 m.

To ensure all individuals were recorded, the botanist undertook a visual inspection covering the area between the traverses being walked (i.e. the mid and upper slope of the hills across the gully were visually inspected from each side). Areas were more thoroughly searched that had a higher likelihood of occurrence, (i.e. gullies, mesa edges etc.), and in areas that could potentially be visually obscured. Visual inspections were also undertaken from all vehicle tracks. Previous records of *Quoya zonalis* within the Survey Areas were confirmed but not re-recorded during the current assessment to avoid duplication of data.

*Quoya zonalis* was recorded to an individual plant level where safe to do so, however often it was recorded as a number of individuals per location (approximately a 5x5 m area) due to the high numbers of individuals and/or unsafe terrain. In some instances where the terrain was too dangerous to walk, records were taken by estimating the location based on the distance from the botanist and estimating the number of plants (see Plate 2.1). These estimated records have been noted in the electronic data provision.



Plate 2.1: *Quoya zonalis* on Steep Slope (Left & Mid) & Recorded from Across Gully (Right)

### 2.4.5. Vegetation Condition Mapping

Vegetation condition was recorded for the Slurry Corridor South Survey Area by taking notes on the condition rating and any disturbance details. Vegetation condition ratings followed the scale recommended for the Eremaean Botanical Province (Environmental Protection Authority, 2016b) which is summarised in Table 2.3.

Table 2.3: Vegetation Condition Scale & Criteria

Condition	Disturbance Criteria
Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; (i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs).

## 2.5. Survey Limitations

Survey specific limitations and constraints for the targeted flora and vegetation assessment are discussed in Table 2.4.

Table 2.4: Limitations & Constraints

Limitation	Comment
Availability of contextual information at a regional and local scale.	Background information for the region was available and sufficient. There were numerous surveys undertaken within the vicinity of the Survey Area which were incorporated into the desktop assessment. Current database searches supplied information on significant flora occurring in the vicinity of the Survey Area.
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed.	Field survey team leader Melissa Hay has 12 years' experience in conducting botanical surveys throughout Western Australia including multiple targeted flora surveys at North Star. The other field botanists have sufficient experience in conducting targeted flora surveys and were trained in target species detection prior to undertaking the field survey.
Restrictions to, or functionality of survey equipment and tools to complete the flora and vegetation assessment.	Equipment supplied was sufficient for the survey and there were no functionality or access issues with equipment and tools used during the survey.
Survey effort and extent.	All Survey Areas were traversed in accordance with the survey plan and current desktop assessment. The WC North area is likely to have more individuals of <i>Quoya zonalis</i> (T) present here than those recorded, however the population extent has been mapped. The WC Re-survey North area was not traversed due to low likelihood of occurrence of Threatened or P1 flora species. One species, <i>Heliotropium parviantrum</i> , was assigned a high priority for survey in the survey plan, however in the updated desktop assessment, the closest



Limitation	Comment
	<p>record to the Survey Area is greater than 50 km and it is considered unlikely to occur. This high priority area was traversed by Ecologia in 2016 and the species was not recorded.</p> <p>Some areas were inaccessible due to dangerous terrain. In these areas the target species <i>Quoya zonalis</i> (T) was visible from distances of up to 150 m from the botanist and estimated locations were recorded.</p>
Access restrictions within the Survey Area.	<p>Access to some areas were restricted due to heritage. One of the heritage areas was expected to contain Threatened or Priority 1 flora taxa, however this area was previously surveyed with records present within. All other heritage areas were considered to have a low likelihood of containing Threatened or Priority 1 flora taxa and was not considered a limitation.</p> <p>Access at the Aerodrome was restricted due to active work areas. No Threatened or Priority 1 flora was expected to occur in this area and was not considered a limitation.</p> <p>Access to the active work areas in the northern section of the Slurry North Corridor was restricted however visual inspections were undertaken and it was not recorded.</p>
Survey timing, rainfall, season of survey.	<p>While the survey was undertaken at a period not optimal for flora and vegetation surveys undertaken in the Pilbara, the majority of the target species were all detectable throughout the year due to their perenniality and ability to be identified using vegetation material.</p> <p>One annual species, <i>Heliotropium parviantrum</i> (P1), was recorded during the desktop assessment and assigned a high priority for survey in the survey plan. This area was traversed in the appropriate season by Ecologia 2016 and considered unlikely to occur following the updated desktop assessment.</p> <p>One perennial herb species, <i>Josephinia</i> sp. Woodstock (A.A. Mitchell PRP 989) (P1), was recorded during the desktop assessment and assigned a medium likelihood of occurrence within the Survey Areas. It is unknown if this species would be present, however it was not recorded during the current assessment.</p>
Disturbance that may have affected the results of survey such as fire, flood or clearing.	<p>No disturbances, including fire, were recorded at the Survey Area that would have affected survey results.</p>

## 3. RESULTS

### 3.1. Significant Flora

Three significant flora taxa were recorded during the assessment:

- Threatened: *Quoya zonalis*;
- Priority 3: *Heliotropium muticum*; and
- Priority 4: *Ptilotus mollis*.

The Threatened taxon, *Quoya zonalis*, was often recorded as groups of plants and was common throughout the WC Camp North, WC Camp South, WC North, and Water Corridor South Re-survey Area. It was recorded on rocky hillslopes high in the landscape, especially on mesa edges and gullies.

The Priority 3 taxon, *Heliotropium muticum*, was recorded as scattered individuals within the Slurry Corridor North and South areas. It was recorded on sandy granitic plains, and often in areas that had been recently burnt.

The Priority 4 taxon, *Ptilotus mollis* was recorded as large clumps of individuals within the WC Camp North, WC Camp South, and WC North area. It was recorded on steep ironstone upper slopes.







These significant flora taxa are described in Table 3.1 and locations are presented in Map 3.1 to Map 3.8. Coordinates were provided electronically with the report.

No other significant flora as defined by EPA (2016a) were recorded in the survey.

### 3.2. Significant Vegetation

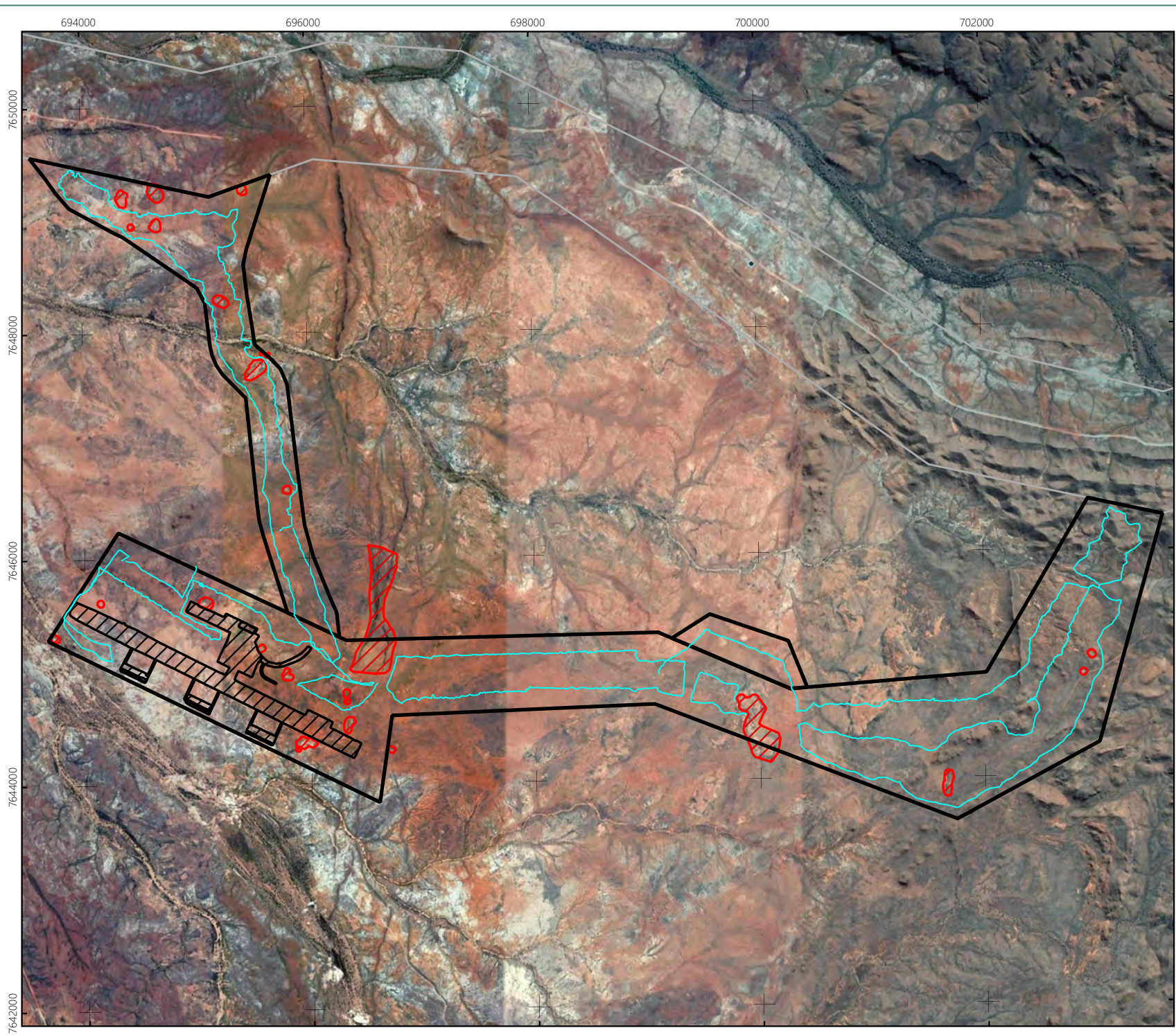
No EPBC or BC Act listed Threatened or Priority Ecological Communities (TECs) or vegetation that resembles these communities were recorded.

Table 3.1: Significant Flora

Taxon	Description	Landforms in Survey Areas	Survey Area & Number of Plants	Regional Distribution	Photograph
T	<i>Quoya zonalis</i>	Shrub to 1 m high. Densely hairy, light grey/white foliage. Flowers pink/white.	High in landscape. Mesa edges, gullies, rocky outcrops, steep upper slopes.  WC Camp North: 38 WC Camp South: 264 (+8 outside)^ WC North: 1,704 (+14 outside) WC Re-survey South: 782 (+2 outside)  <b>Total: 2,812</b>		
P3	<i>Heliotropium muticum</i>	Ascending to spreading perennial herb, to 0.3 m high. Flowers white.	Orange sandy plains, often with granite outcropping and following burns.  SC North: 55 SC South: 67  <b>Total: 122</b>		
P4	<i>Ptilotus mollis</i>	Compact, perennial shrub, to 0.5 m high, soft grey foliage. Flowers white/pink.	Steep upper ironstone slopes.  WC Camp North: 32 WC Camp South: 39 WC North: 26  <b>Total: 97</b>		


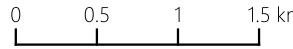
^ = plants recorded just outside the boundary of the Survey Area






### Legend

- Significant Flora Records**
- T - Quoya zonalis
  - P3 - Heliotropium muticum
  - P4 - Ptilotus mollis
- Desktop Survey Records**
- ◆ T - Quoya zonalis
- Traverse
- ▭ Survey Area
- ▨ Airport
- ▭ Development Envelopes
- ▨ Heritage Areas



  
 Scale 1:50,000 @ A4

Coordinate System: GDA 1994 MGA Zone 50  
 Projection: Transverse Mercator  
 Units: Meter


Author: Melissa Hay Date: 18-11-2020

## Significant Flora & Traverses – Aerodrome & Infrastructure

Targeted Flora & Vegetation Survey, Iron Bridge



660000

662000

664000

666000

668000

7746000

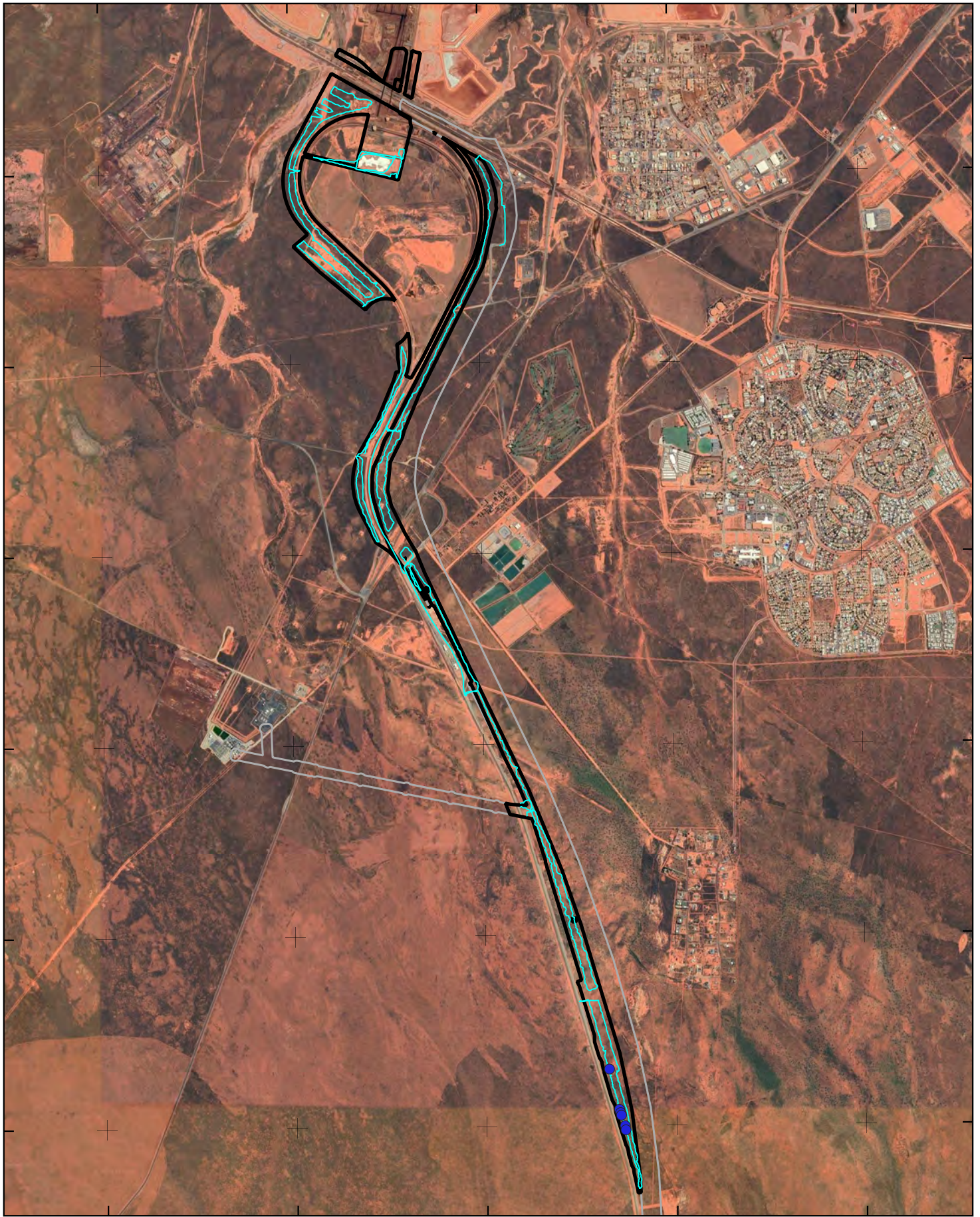
7744000

7742000

7740000

7738000

7736000



**Legend**

**Significant Flora Records**

- T - Quoya zonalis
- P3 - Heliotropium muticum
- P4 - Ptilotus mollis

**Desktop Survey Records**

- ◆ T - Quoya zonalis

- Traverse
- Survey Area
- Development Envelopes
- Heritage Areas



0 0.5 1 1.5 km

Scale 1:56,500

@ A4

Coordinate System: GDA 1994 MGA Zone 51  
Projection: Transverse Mercator  
Units: Meter



Author: MH

Date: 18-11-2020

Significant Flora & Traverses –  
Slurry Corridor North

Targeted Flora &  
Vegetation Survey, Iron  
Bridge

Prepared for Iron Bridge

MAP

3.2



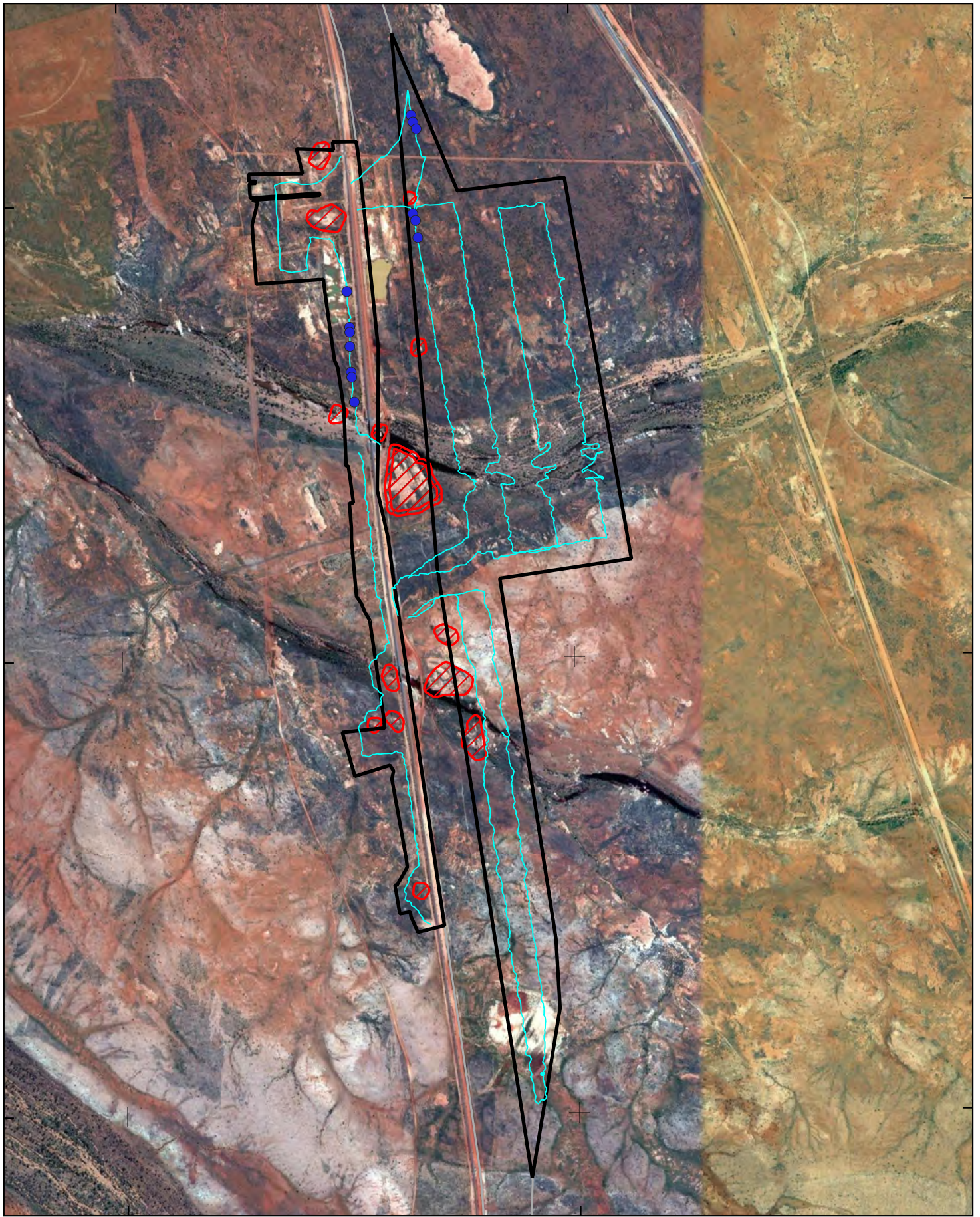
676000

678000

7676000

7674000

7672000



**Legend**

**Significant Flora Records**

- T - Quoya zonalis
- P3 - Heliotropium muticum
- P4 - Ptilotus mollis

**Desktop Survey Records**

- ◆ T - Quoya zonalis

- Traverse
- Survey Area
- Development Envelopes
- Heritage Areas



0 0.25 0.5 0.75 km

Scale 1:23,800

@ A4

Coordinate System: GDA 1994 MGA Zone 51  
Projection: Transverse Mercator  
Units: Meter



Author: MH

Date: 18-11-2020

Significant Flora & Traverses –  
Slurry Corridor South

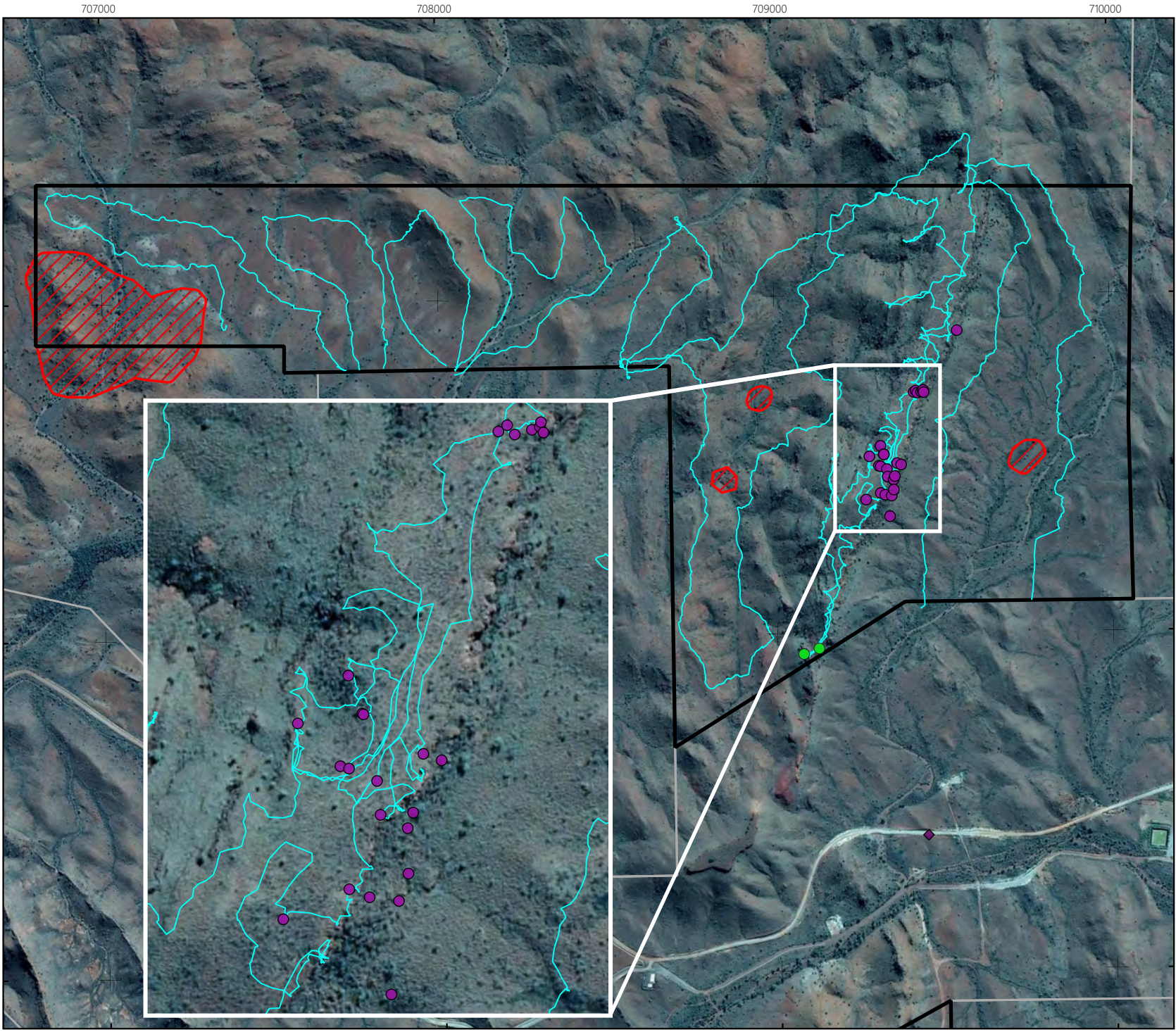
Targeted Flora &  
Vegetation Survey, Iron  
Bridge

Prepared for Iron Bridge

MAP

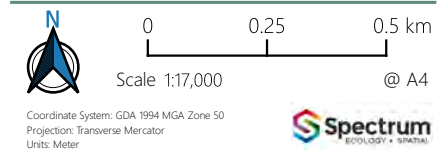
3.3





## Legend

- Significant Flora Records**
- T - Quoya zonalis
  - P3 - Heliotropium muticum
  - P4 - Ptilotus mollis
- Desktop Survey Records**
- ◆ T - Quoya zonalis
  - Traverse
  - ▭ Survey Area
  - ▭ Development Envelopes
  - ▨ Heritage Areas



Author: Melissa Hay

Date: 18-11-2020

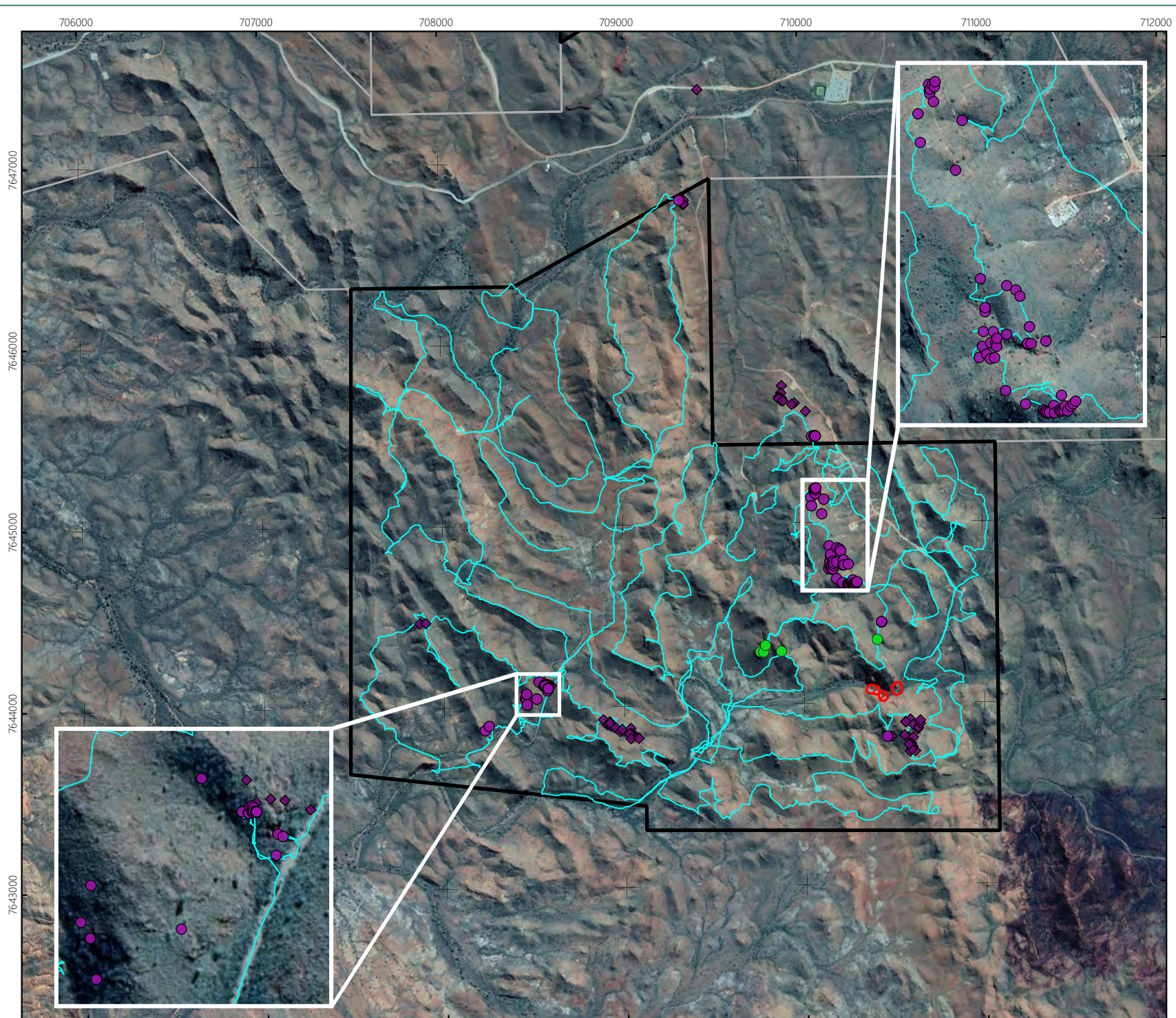
## Significant Flora & Traverses – Water Corridor Camp North

Targeted Flora & Vegetation Survey, Iron Bridge

Prepared for  
Iron Bridge

MAP  
3.4







### Legend

- Significant Flora Records
  - T - *Quoya zonalis*
  - P3 - *Heliotropium muticum*
  - P4 - *Ptilotus mollis*
- Desktop Survey Records
  - T - *Quoya zonalis*
- Traverse
- Survey Area
- Development Envelopes
- Heritage Areas




 Scale 1:31000 @ A4  
 Coordinate System: GDA 1994 MGA Zone 50  
 Projection: Transverse Mercator  
 Units: Meter

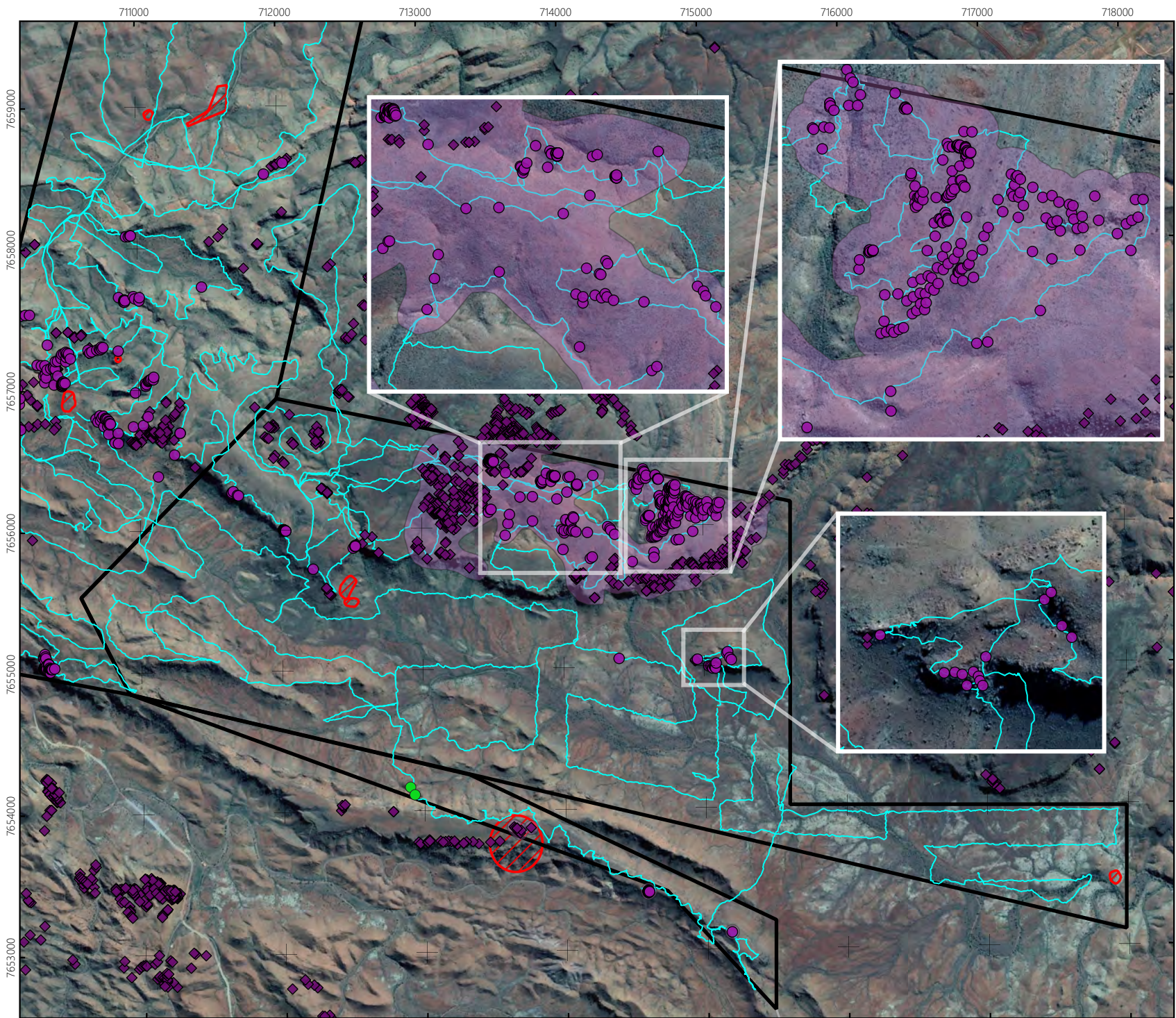


Author: Melissa Hay Date: 18-11-2020

## Significant Flora & Traverses – Water Corridor Camp South

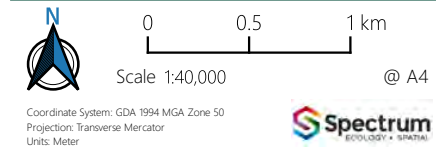
Targeted Flora & Vegetation Survey, Iron Bridge





## Legend

- Significant Flora Records**
- T - Quoya zonalis
  - P3 - Heliotropium muticum
  - P4 - Ptilotus mollis
  - Quoya Zonalis Northern Mesa Extent
- Desktop Survey Records**
- ◆ T - Quoya zonalis
- Other Features**
- Traverse
  - Survey Area
  - Development Envelopes
  - Heritage Areas



Author: Melissa Hay

Date: 18-11-2020

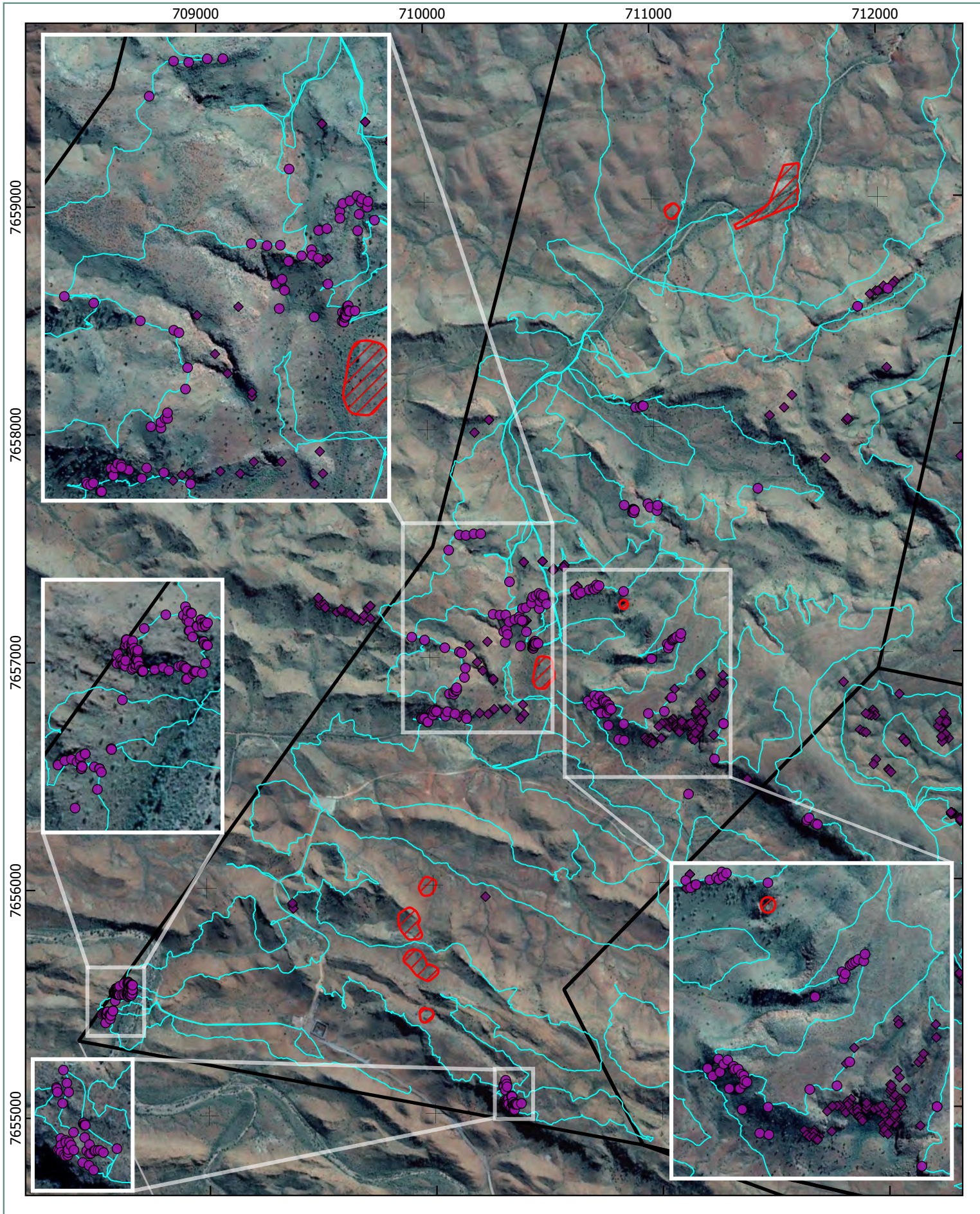
## Significant Flora & Traverses – Water Corridor North

Targeted Flora & Vegetation Survey, Iron Bridge

Prepared for  
Iron Bridge

MAP  
**3.6**





**Legend**

**Significant Flora Records**

- T - Quoya zonalis
- P3 - Heliotropium muticum
- P4 - Ptilotus mollis

**Desktop Survey Records**

- ◆ T - Quoya zonalis

- Traverse
- Survey Area
- Development Envelopes
- Heritage Areas



0 0.25 0.5 0.75 km

Scale 1:23000

@ A4

Coordinate System: GDA 1994 MGA Zone 51  
Projection: Transverse Mercator  
Units: Meter



Author: MH

Date: 18-11-2020

Significant Flora & Traverses –  
Water Corridor Re-survey  
South A

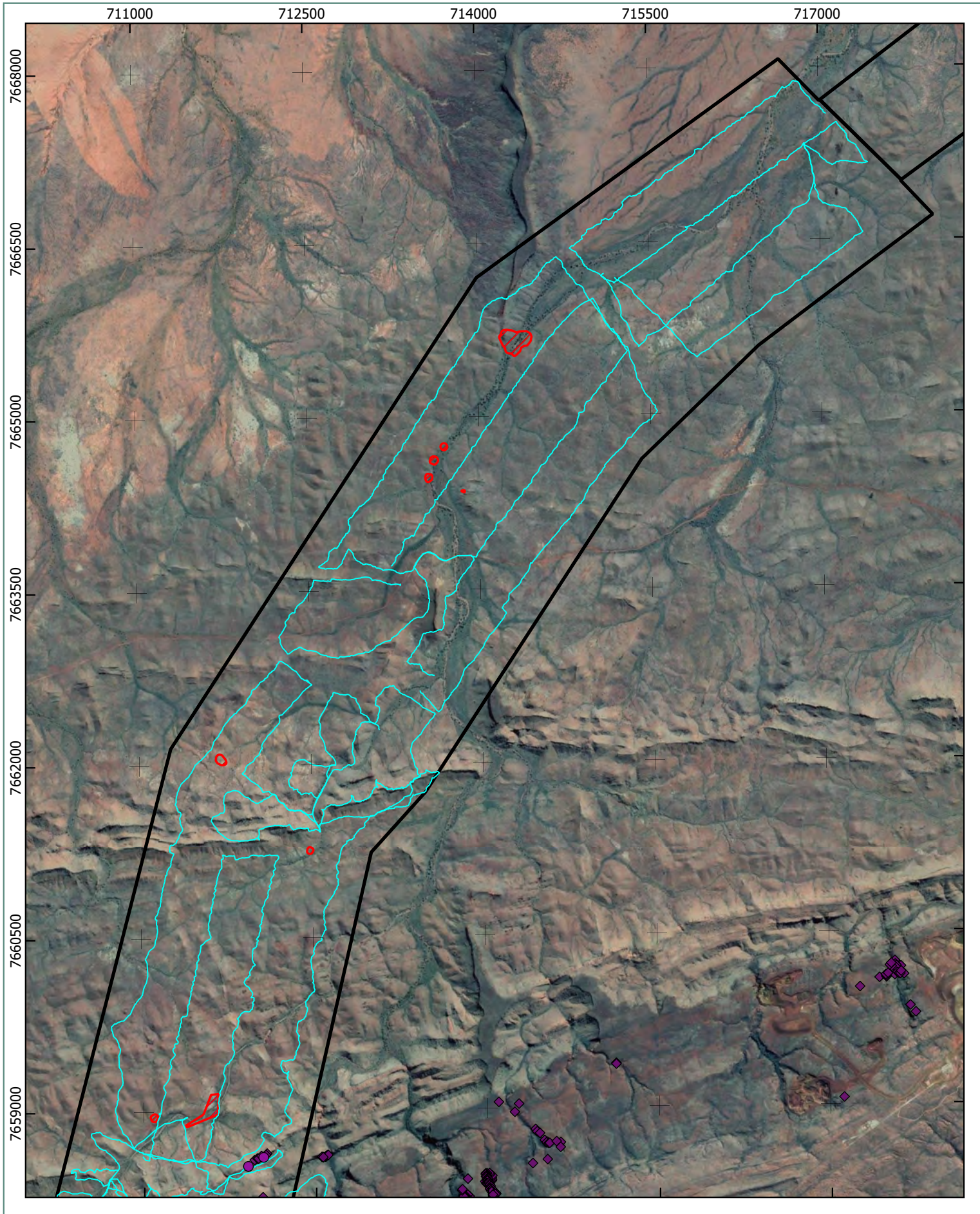
Targeted Flora &  
Vegetation Survey, Iron  
Bridge

Prepared for Iron Bridge

MAP

3.7





**Legend**

**Significant Flora Records**

- T - Quoya zonalis
- P3 - Heliotropium muticum
- P4 - Ptilotus mollis

**Desktop Survey Records**

- ◆ T - Quoya zonalis

- Traverse
- Survey Area
- Development Envelopes
- Heritage Areas



0 0.5 1 1.5 km

Scale 1:45500

@ A4

Coordinate System: GDA 1994 MGA Zone 51  
 Projection: Transverse Mercator  
 Units: Meter



Author: MH

Date: 18-11-2020

Significant Flora & Traverses –  
 Water Corridor Re-survey  
 South B

Targeted Flora &  
 Vegetation Survey, Iron  
 Bridge

Prepared for Iron Bridge

MAP

3.8



### 3.3. Vegetation Condition of Slurry Corridor

Vegetation condition at the Slurry Corridor Survey Area is presented in Table 3.2 and mapped in Map 3.9. The majority of the Survey Area was mapped as Excellent (78.1%) with no signs of disturbance throughout and included the flat plains. Areas mapped as Very Good (10.5%) included the creek lines which were characterised by moderate grazing levels and trampling, and areas alongside the rail which had an altered vegetation structure due to minor erosion. Areas mapped as Degraded (2.2%) were borrow pits where there was some regeneration occurring. Areas mapped as Completely Degraded (9.3%) were areas completely devoid of vegetation and included some borrow pits, the rail and cleared tracks.

**Table 3.2: Vegetation Condition at the Slurry Corridor South Survey Area**

Vegetation Condition	Area in Survey Area	% of Survey Area	Disturbance Details
Excellent	214.3	78.1	Vegetation structure intact, no obvious signs of disturbance. Including the majority of the flat plains of the Survey Area
Very Good	28.7	10.5	Vegetation structure altered with minor signs of disturbance. Disturbance to vegetation structure caused by grazing, trampling, and very scattered weeds. Including along creek lines and some areas alongside the rail effected by erosion.
Good	0	0	No areas classified as Good.
Degraded	6.0	2.2	Vegetation structure severely impacted by clearing. Scope for some regeneration but not to a state approaching good condition without intensive management. Including some of the areas cleared for borrow pits. Clumps of weeds present and high levels of grazing.
Completely Degraded	25.4	9.3	Vegetation structure is no longer intact, completely, or almost completely without native species. Including the rail, tracks, and borrow pits devoid of native vegetation.

#### 3.3.1. Introduced Flora

Two introduced flora species were recorded at the Slurry Corridor South Area including *\*Cenchrus ciliaris* and *\*Flaveria trinervia*. The number of plants and location are presented in Table 3.3 and they are mapped on Map 3.9.

**Table 3.3: Introduced Flora Recorded at the Slurry Corridor South Survey Area**

Taxon	Number of Plants	Zone	Easting	Northing	Description of Location
<i>*Cenchrus ciliaris</i>	500	50	677773	7672289	Borrow pit
<i>*Cenchrus ciliaris</i>	1,000	50	677570	7674774	Between granite boulders
<i>*Flaveria trinervia</i>	1	50	677713	7673664	Along creekline



676000

678000



7676000

7674000



7672000



**Legend**

-  Survey Area
-  Development Envelopes

**Introduced Flora**

-  \*Cenchrus ciliaris
-  \*Flaveria trinervia

**Vegetation Condition**

-  Excellent
-  Very Good
-  Degraded
-  Completely Degraded



0 0.25 0.5 0.75 km

Scale 1:23800

@ A4

Coordinate System: GDA 1994 MGA Zone 51  
Projection: Transverse Mercator  
Units: Meter



Author: MH

Date: 18-11-2020

Vegetation Condition & Introduced Flora at the Slurry Corridor South

Targeted Flora & Vegetation Survey, Iron Bridge

Prepared for Iron Bridge

MAP

3.9



## 4. DISCUSSION

### 4.1. Post Survey Likelihood of Occurrence of Threatened & Priority 1 Taxa

The likelihood of occurrence prior to and following the field survey for each Threatened and Priority 1 species assigned a High or Medium likelihood of occurrence in the desktop assessment are presented in the following sections. Species only assigned a low likelihood of occurrence prior to the field survey, were still considered to have a low likelihood of occurrence post survey.

#### 4.1.1. *Quoya zonalis*

Location	Pre-survey Likelihood	Post-survey Likelihood & Discussion
Aerodrome	High	Low – potential habitat recorded in the hills to the east however no <i>Quoya zonalis</i> recorded. Other areas no potential habitat recorded.
IC	Low	Low – no potential habitat.
SC North	Low	Low – no potential habitat.
SC South	Medium	Low – no potential habitat.
WC Camp North	High	Recorded – along the ridge of the hills to the east only. Other areas no potential habitat recorded.
WC Camp South	Recorded	Recorded – habitat recorded across area. <i>Quoya zonalis</i> mostly recorded on the larger range of hills to the east with scattered populations recorded on the hills to the south-west. Other areas were searched and <i>Quoya zonalis</i> was not recorded.
WC North	Recorded	Recorded – large numbers recorded on the top of the mesa in the north. Some individuals not recorded in this area and therefore the population extent was determined. Another population recorded on a small mesa to the south of the large population and one individual on a rocky outcrop. Mesa along the southern edge with scattered individuals. There was no potential habitat in the other areas in the plain between the two ranges.
WC Re-survey North	Medium	Low – no potential habitat.
WC Re-survey South	High	Recorded – large population found on the top of the mesa in the southern area. Potential habitat was present through most of the rest of the south area and in the remaining hills to the north of the recorded population but <i>Quoya zonalis</i> was not recorded.

#### 4.1.2. *Acacia cyperophylla* var. *omearana*

Location	Pre-survey Likelihood	Post-survey Likelihood & Discussion
Aerodrome	Low	Low – no potential habitat.
IC	Low	Low – no potential habitat.
SC North	Low	Low – no potential habitat.
SC South	Low	Low – no potential habitat.
WC Camp North	Low	Low – no potential habitat.
WC Camp South	Low	Low – no potential habitat.
WC North	Low	Low – no potential habitat.
WC Re-survey North	Medium	Low – one creekline crosses Survey Area and was searched by Ecologia 2016 and not recorded.
WC Re-survey South	Low	Low – no potential habitat.

#### 4.1.3. *Acacia leeuweniana*

Location	Pre-survey Likelihood	Post-survey Likelihood & Discussion
Aerodrome	Medium	Low – few scattered granite outcrops which were searched, and not recorded. These areas likely too small to be potential habitat.
IC	Medium	Low – few scattered granite outcrops which were searched, and not recorded. These areas likely too small to be potential habitat.
SC North	Low	Low – no potential habitat.
SC South	Low	Low – no potential habitat.



Location	Pre-survey	Post-survey Likelihood & Discussion
WC Camp North	Low	Low – no potential habitat.
WC Camp South	Low	Low – no potential habitat.
WC North	Low	Low – no potential habitat.
WC Re-survey North	Low	Low – no potential habitat.
WC Re-survey South	Low	Low – no potential habitat.

#### 4.1.4. *Heliotropium parviantrum*

Location	Pre-survey	Post-survey Likelihood & Discussion
Aerodrome	Low	Low – no potential habitat.
IC	Low	Low – no potential habitat.
SC North	Low	Low – no potential habitat.
SC South	Low	Low – no potential habitat.
WC Camp North	Low	Low – no potential habitat.
WC Camp South	Low	Low – no potential habitat.
WC North	Low	Low – no potential habitat.
WC Re-survey North	High	Low – area assigned high in the survey plan was searched by Ecologia 2016 and not recorded. Closest known record in current desktop assessment was >50 km north and species is unlikely to occur within the Survey Area.
WC Re-survey South	Low	Low – no potential habitat.

#### 4.1.5. *Josephinia* sp. Woodstock (A.A. Mitchell PRP 989)

Location	Pre-survey	Post-survey Likelihood & Discussion
Aerodrome	Medium	Low – no potential habitat.
IC	Medium	Low – one drainage line through Survey Area which could be potential habitat. This was searched and not recorded, however as a perennial herb it is unknown if it would be present. Due to surveys conducted as listed in section 5, it has been assigned a low likelihood post survey.
SC North	Low	Low – no potential habitat.
SC South	Low	Low – no potential habitat.
WC Camp North	Low	Low – no potential habitat.
WC Camp South	Low	Low – no potential habitat.
WC North	Low	Low – no potential habitat.
WC Re-survey North	Low	Low – no potential habitat.
WC Re-survey South	Low	Low – no potential habitat.

#### 4.1.6. *Tephrosia rosea* var. Port Hedland (A.S. George 1114)

Location	Pre-survey	Post-survey Likelihood & Discussion
Aerodrome	Low	Low – no potential habitat.
IC	Low	Low – no potential habitat.
SC North	High	Medium – previous records noted just outside Survey Area along the disturbed roadside. The disturbed areas around existing infrastructure were visually searched only due to access constraints and it was not recorded. Some of these areas could not be visually inspected as they were too far to see, however these areas appear to be mostly cleared and it is unlikely to occur. All other areas were thoroughly searched and no <i>Tephrosia</i> species were recorded.
SC South	Low	Low – no potential habitat.
WC Camp North	Low	Low – no potential habitat.
WC Camp South	Low	Low – no potential habitat.
WC North	Low	Low – no potential habitat.
WC Re-survey North	Low	Low – no potential habitat.
WC Re-survey South	Medium	Low – no potential habitat.

## 5. CONCLUSION

Targeted searches at all Survey Areas were undertaken in accordance with the North Star Significant Flora and Vegetation Survey Plan (NS-PL-EN-005).

One Threatened and 11 Priority 1 taxa were identified during the desktop assessment as occurring within 80 km of the Survey Areas. Three taxa were assigned a High and five were assigned a Medium likelihood of occurrence within the Survey Areas prior to the field survey:

Pre-survey High Likelihood:

- T – *Quoya zonalis*: WC North, WC Camp North, WC Camp South, WC Re-survey South, Aerodrome;
- P1 – *Heliotropium parviantrum*: WC Re-survey North; and
- P1 – *Tephrosia rosea* var. Port Hedland (A.S. George 1114): SC North.

Pre-survey Medium Likelihood:

- T – *Quoya zonalis*: SC South, WC Re-survey North;
- P1 – *Acacia cyperophylla* var. *omearana*: WC Re-survey North;
- P1 – *Acacia leeuweniana*: SC South;
- P1 – *Josephinia* sp. Woodstock (A.A. Mitchell PRP 989): IC, Aerodrome; and
- P1 – *Tephrosia rosea* var. Port Hedland (A.S. George 1114): WC Re-survey North.

*Quoya zonalis* (Threatened) was the only Threatened or Priority 1 flora taxon recorded during the survey. This taxon was recorded in large numbers across the WC North, WC Camp North, WC Camp South, and WC Re-survey South. Following the survey, it was considered to have a Low likelihood of occurrence in the remaining Survey Areas. In the WC North Survey Area there may be more individuals present than what was recorded, and the population extent has been mapped.

*Tephrosia rosea* var. Port Hedland (A.S. George 1114) was assigned a High likelihood of occurrence in the SC North Survey Area. However, following the survey, it has been assigned a Medium likelihood of occurrence in the disturbed areas that could not be visually inspected. It is not considered to occur in the remaining areas.

*Josephinia* sp. Woodstock (A.A. Mitchell PRP 989) was assigned a Medium likelihood of occurrence pre survey as a precautionary measure due to the unknown nature of the perennality of the species and unknown presence because of survey timing. However, it is considered unlikely that the species occurs in this location, since the closest records of the species are greater than 30 km south of the development envelopes. Further, DBCA records (35-01020FL, 28 October 2020) indicate there are no known records of the species further north or in the vicinity of the project. In addition, *Josephinia* sp. Woodstock (A.A. Mitchell PRP 989) has not been recorded in previous targeted flora surveys conducted in immediately adjacent sections of the development corridors (ecologia Environment, 2015; 2016; Ecoscape (Australia), 2011) or in any of the extensive Level 2 (comprehensive) surveys across the development envelopes (Biota Environmental Sciences, 2004; Coffey Environments, 2007; ENV Australia, 2008; Ecoscape (Australia), 2010; ecologia Environment, 2012a, 2012b, 2012c, 2012d; 2015) and recent expansion areas (Ecoscape (Australia), 2018). Consequently, the likelihood of occurrence of the species occurring is Low.

All other Priority 1 taxa recorded during the desktop assessment were assigned a Low likelihood of occurrence in the Survey Areas post field survey. No other significant flora as defined by EPA (2016a) were recorded in the survey.



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## Appendix A: Conservation Codes & Significant Definitions





## Appendix A1: Definitions of Conservation Categories under the EPBC Act

Category	Definition
<b>Extinct</b>	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
<b>Extinct in the Wild</b>	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
<b>Critically Endangered</b>	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
<b>Endangered</b>	A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
<b>Vulnerable</b>	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
<b>Conservation Dependent</b>	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered, or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

## Appendix A2: Definitions of Priority Species Classification (DBCA 2019)

**Priority species:** Possibly Threatened species that do not meet survey criteria or are otherwise data deficient, are added to the Priority flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as Threatened flora.

Species that are adequately known, are rare but not Threatened, or meet criteria for near Threatened, or that have been recently removed from the Threatened species, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Category	Definition
P1	<p><b>Priority 1: Poorly-known species</b></p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
P2	<p><b>Priority 2: Poorly-known species</b></p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
P3	<p><b>Priority 3: Poorly-known species</b></p> <p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
P4	<p><b>Priority 4: Rare, Near Threatened and other species in need of monitoring</b></p> <p>(a) Rare. Species 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 species are usually represented on conservation lands.</p> <p>(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.</p> <p>(c) Species that have been removed from the list of Threatened species during the past five years for reasons other than taxonomy</p>



### Appendix A3: Significant Flora & Vegetation Definitions

Significant flora can include (EPA, 2016a):

- Being identified as Threatened: Critically Endangered, Endangered or Vulnerable (state listed BC Act and/or nationally listed EPBC Act);
- Being identified as Priority flora species: Priority 1 to 4 (DBCA, 2019);
- Locally endemic or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- New species or anomalous features that indicate a potential new species;
- Representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- Unusual species, including restricted subspecies, varieties or naturally occurring hybrids; or
- Relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Significant vegetation can include (EPA, 2016a):

- Threatened Ecological Community (TEC): Critically Endangered, Endangered or Vulnerable (state listed BC Act and/or nationally listed EPBC Act);
- Priority Ecological Community (PEC): Priority 1 to 5 (DBCA, 2017);
- Restricted distribution;
- Degree of historical impact from threatening processes;
- A role as a refuge; or
- Providing an important function required to maintain ecological integrity of a significant ecosystem.

## Appendix B: Likelihood of Occurrence Assessment





Status	Family	Taxon	Description	Longevity	Lifeform	Flowering Period	Habitat	Aero-drome	IC	SC North	SC South	WC Camp North	WC Camp South	WC North	WC Re-survey North	WC Re-survey South
T	Lamiaceae	Quoya zonalis	Shrubs. Stems, cross section more or less circular.	Perennial	Shrub	Aug.	Steep ironstone upper slopes and ridgetops. Gullies.	3	9	>50	30^	1	0	0	10	0
P1	Fabaceae	Acacia cyperophylla var. omearana	Tree, 4-10 m high, 'minni-ritchi' bark. Fl. Yellow.	Perennial	Shrub / Tree	Mar to Apr.	Stony & gritty alluvium. Along drainage lines.	>50	>50	>50	>50	>50	>50	>50	15	48
P1	Fabaceae	Acacia leeuweniana	Narrow, obconic tree, to 14 m high, bark minni ritchi; inflorescence in spikes.	Perennial	Shrub / Tree	Apr-May, Oct.	Gritty, skeletal red-grey sandy loam, light orange-brown gravelly sand, granite. In rock fissures in outcrops, among boulders.	8	9	>50	27	21	21	26	40	24
P1	Fabaceae	Acacia sp. Marble Bar (J.G. & M.H. Simmons 3499)	Shrub, inflorescence in spikes, to 30mm long. Fl. Yellow.	Perennial	Shrub	Sep.	Dry watercourse among low rocky hills in unconsolidated sand.	>50	>50	>50	>50	>50	>50	>50	>50	>50
P1	Chenopodiaceae	Atriplex eremitis	Bushy sparse shrub with grey foliage growing up to 0.3 m tall.	Perennial	Shrub	Unknown.	Semi saline plain in a saline patch. Coastal.	>50	>50	48	>50	>50	>50	>50	>50	>50
P1	Bixaceae	Cochlospermum macnamarae	Deciduous, spreading, multi-stemmed shrub to 2 m high.	Perennial	Shrub	Unknown.	Hill with exposed granite faces and domes. Sheeted granite outcrop, with boulders. Skeletal brown sand.	>50	>50	>50	>50	>50	>50	>50	>50	>50
P1	Malvaceae	Corchorus sp. Yarrie (J. Bull & D. Roberts CAL 01.05)	Herb or shrub to 1.5m. Stems hairy. Leaves 20-35 mm long, 8-15 mm wide, not lobed; margins crenate or sinuate; indumentum present, with stellate hairs.	Perennial	Shrub	June to Nov	Steep midslope, brown clay loam. Cliff, upper slope, brown sandy clay loam.	>50	>50	>50	>50	>50	>50	43	14	35
P1	Cyperaceae	Fimbristylis sp. Shay Gap (K.R. Newbey 10293)	Tufted annual, grass-like or herb (sedge), 0.12-0.15 m high, inflorescence of 3-many spikelets; glumes 2-2.5 mm long; stamens 3, anthers 0.5-0.6 mm long.	Annual	Sedge	Jun to Jul.	Sandy soil. Drainage line.	>50	>50	>50	>50	>50	>50	>50	>50	>50
P1	Boraginaceae	Heliotropium parviantrum	Erect annual, herb, to 0.15 m high. Fl.	Annual	Herb	Feb to Jun.	Sandy soils. Flats, plains, rocky slopes.	>50	>50	>50	>50	>50	>50	>50	45*^	>50

Status	Family	Taxon	Description	Longevity	Lifeform	Flowering Period	Habitat	Aero-drome	IC	SC North	SC South	WC Camp North	WC Camp South	WC North	WC Re-survey North	WC Re-survey South
P1	Pedaliaceae	Josephinia sp. Woodstock (A.A. Mitchell PRP 989)	Herb with pink flowers and densely hairy foliage and stems, growing up to 0.2 m tall.	Perennial	Herb	Unknown.	Sandy-surfaced flow line below low granitic rises.	31	33	>50	>50	35	30	42	>50	42
P1	Cyperaceae	Schoenus coultasii	Tufted grass like herb to 0.15 m	Annual	Sedge	May?	Granite seepage area. Brown sandy loam. With Eragrostis cumingii, other herbs and sedges.	>50	>50	>50	>50	>50	>50	>50	>50	>50
P1	Fabaceae	Tephrosia rosea var. Port Hedland (A.S. George 1114)	Erect shrub to 0.75 m high, 1 m wide with flowers and fruit. Flowers deep pink.	Perennial	Shrub	Aug to Sep	Plain with red-brown, yellow sandy soils. Road verges.	>50^	>50^	0	>50	>50	>50	>50	>50^	>50
P2	Euphorbiaceae	Euphorbia inappendiculata var. inappendiculata	Herb to 2 cm.	Annual	Herb	Unknown.	Flat, red brown loam. Cracking clay.	47	>50	>50	>50	39	42	28	9	22
P2	Amaranthaceae	Gomphrena pusilla	Slender branching annual, herb, to 0.2 m high. Fl. white.	Annual	Herb	Mar to Apr or Jun.	Fine beach sand. Behind foredune, on limestone. Limestone ridge top of brown loam and exposed calcrete rock.	>50	>50	5	>50	>50	>50	>50	>50	>50
P3	Malvaceae	Abutilon sp. Pritzelianum (S. van Leeuwen 5095)	Tall grey spreading shrub with yellow flowers, growing up to 2 m tall.	Perennial	Shrub	Unknown.	Sandplain with orange brown sandy loam. Roadsides.	5*^	4*^	9	23^	5*^	5*^	5*^	10^	10^
P3	Fabaceae	Acacia levata	Spreading, multi-stemmed shrub, 1-3 m high, to 5 m wide. Fl. Yellow.	Perennial	Shrub	May	Sand or sandy loam over granite. Hillslopes.	19	20	>50	35	32	30	39	49	38
P3	Poaceae	Eragrostis crateriformis	Annual, grass-like or herb, 0.17-0.42 m high.	Annual	Herb	Jan to May or Jul.	Clayey loam or clay. Creek banks. Depressions.	1	2	5	6	20	12	20	0	24
P3	Euphorbiaceae	Euphorbia clementii	Erect herb, to 0.6 m high.	Annual	Herb	May.	Gravelly hillsides, stony grounds.	5	4	46	10	8	7	13	0	28



Status	Family	Taxon	Description	Longevity	Lifeform	Flowering Period	Habitat	Aero-drome	IC	SC North	SC South	WC Camp North	WC Camp South	WC North	WC Re-survey North	WC Re-survey South
P3	Cyperaceae	Fimbristylis sieberiana	Shortly rhizomatous, tufted perennial, grass-like or herb (sedge), 0.25-0.6 m high. Fl. brown.	Perennial	Sedge	May to Jun.	Mud, skeletal soil pockets. Pool edges. Sandstone cliffs.	10	15	>50	46	12	10	18	32	20
P3	Amaranthaceae	Gomphrena cucullata	Spreading or erect annual, herb, to 0.25 m high, bracteoles forming hoods over the tepals. Fl. white/pink/purple.	Annual	Herb	Feb or May.	Red sandy loam, clayey sand. Open floodplains.	>50	>50	>50	>50	>50	>50	>50	>50	>50
P3	Amaranthaceae	Gomphrena leptophylla	Prostrate or erect to spreading annual, herb, to 0.15 m high. Fl. White.	Annual	Herb	Mar to Sep	Sand, sandy to clayey loam, granite, quartzite. Open flats, sandy creek beds, edges salt pans & marshes, stony hillsides.	14	12	6	6	23	25	27	36	25
P3	Apocynaceae	Gymnanthera cunninghamii	Erect shrub, 1-2 m high. Fl. cream-yellow-green.	Perennial	Shrub	Jan to Dec.	Sandy soils. Drainage lines.	10	8	4	1	20	22	25	35	23
P3	Boraginaceae	Heliotropium murinum	Short-lived perennial, herb, up to 0.4 m high. Fl.	Perennial	Herb	May or Sep.	Red sand. Plains.	35	37	>50	>50	38	34	33	0	40
P3	Boraginaceae	Heliotropium muticum	Ascending to spreading perennial, herb, to 0.3 m high.	Perennial	Herb	Oct, Nov.	Sandy plain of orange brown sandy loam. Recently burnt.	12	9	8	2	20	22	17	0	7
P3	Solanaceae	Nicotiana umbratica	Erect, short-lived annual or perennial, herb, 0.3-0.7 m high. Fl. white.	Annual / Perennial	Herb	Apr to Jun.	Shallow soils. Rocky outcrops. Granite.	11	9	>50	7	22	20	25	34	26
P3	Rubiaceae	Oldenlandia sp. Hamersley Station (A.A. Mitchell PRP 1479)	Spreading annual, herb, 0.05-0.1 m high. Fl. blue, Mar.	Annual	Herb	Mar.	Cracking clay. Basalt. Gently undulating plain with large surface rocks. Flat crabhole plain.	46	>50	>50	>50	38	40	31	10	22
P3	Phyllanthaceae	Phyllanthus hebecarpus	Low shrub to 0.5 m high.	Perennial	Shrub	Unknown.	Granite outcrop. Red sandy loam. Drainage line/Washout. Very gentle slope. Red clay loam, granite and quartz loose rocks, with some granite outcropping.	10	7	>50	22	21	22	24	36	22

Status	Family	Taxon	Description	Longevity	Lifeform	Flowering Period	Habitat	Aero-drome	IC	SC North	SC South	WC Camp North	WC Camp South	WC North	WC Re-survey North	WC Re-survey South
P3	Acanthaceae	Rostellularia adscendens var. latifolia	Herb or shrub, 0.1-0.3 m high. Fl. blue-purple-violet.	Perennial	Herb	Apr to May.	Drainage area with red-brown loam soils. Ironstone soils. Creeks. Rocky hills.	>50	>50	>50	>50	>50	>50	>50	>50	>50
P3	Fabaceae	Rothia indica subsp. australis	Prostrate annual, herb, to 0.3 m high, densely covered in spreading hairs.	Annual	Herb	Apr to Aug.	Sandy soils. Sandhills and sandy flats.	46	42	13	11	37*	33*	46*	10*	46*
P3	Malvaceae	Sida sp. Barlee Range (S. van Leeuwen 1642)	Spreading shrub, to 0.5 m high. Fl. yellow, Aug.	Perennial	Shrub	Aug.	Skeletal red soils pockets. Steep slope.	>50	>50	18	>50	>50	>50	>50	>50	>50
P3	Stylidiaceae	Stylidium weeliwolli	Annual, herb, 0.1-0.25 m high, throat appendages 4, rod-shaped. Fl. pink & red.	Annual	Herb	Aug to Sep.	Gritty sand soil, sandy clay. Edge of watercourses.	7	8	>50	7	19	20	25	38	23
P3	Combretaceae	Terminalia supranitifolia	Spreading, tangled shrub or tree, 1.5-3 m high. Fl. green-yellow.	Perennial	Shrub / Tree	May or Jul or Dec.	Sand. Among basalt rocks.	17	13	>50	15	22	24	23	28	20
P3	Poaceae	Triodia basitricha	Spinifex to 0.5 m. Curly leaves.	Perennial	Hummock Grass	Unknown.	Hill slopes. Crest of range. Skeletal clay loam over ironstone.	23	27	>50	44	17	19	9	7	7
P3	Poaceae	Triodia chichesterensis	Spinifex, hummocks to 40 cm high. Short blue-green leaves.	Perennial	Hummock Grass	Unknown.	Hillslope with dense quartz straw and shallow 0.2 m deep loam soil onto decomposing basalt bedrock. Well-drained red stony loamy sand. Flat plain. On calcrete mesa in bottomlands near river.	5	7	32	1	12	9	19	10	24
P3	Fabaceae	Vigna triodiophila	Fine, sprawling herb with yellow flowers. Terete stems.	Perennial	Herb	March & May	Among dolerite boulders on very steep upper slope. Stony red-brown clay loam.	24	22	>50	14	35	35	38	45	36
P4	Cyperaceae	Bulbostylis burbidgeae	Tufted, erect to spreading annual, grass-like or herb (sedge), 0.03-0.25 m high.	Annual	Sedge	Mar or Jun to Aug.	Rocky outcrops and boulders.	9	10	0	4	22	19	33	20	24
P4	Goodeniaceae	Goodenia nuda	Erect to ascending herb, to 0.5 m high. Fl. yellow.	Perennial	Herb	Apr to Aug.	Drainage line. Red/brown clay loam soils. Floodplains. Brown loam/ironstone.	30	27	3	3	37	38	35	41	37



Status	Family	Taxon	Description	Longevity	Lifeform	Flowering Period	Habitat	Aero-drome	IC	SC North	SC South	WC Camp North	WC Camp South	WC North	WC Re-survey North	WC Re-survey South
P4	Amaranthaceae	<i>Ptilotus mollis</i>	Compact, perennial shrub, to 0.5 m high, soft grey foliage. Fl. white/pink.	Perennial	Shrub	May or Sep.	Moderately steep midslope of BIF.	10	18	27	40	5	3	8	20	9
P4	Fabaceae	<i>Rhynchosia bungarensis</i>	Compact, prostrate or spreading shrub, to 0.5 m high.	Perennial	Shrub	May, July, Nov.	Gently inclined drainage depression. Brown silty loam soil.	>50	>50	>50	>50	>50	>50	>50	>50	>50

Red = High, Yellow = Medium, Green = Low likelihood of occurrence, IC = Infrastructure Corridor, SC = Slurry Corridor, WC = Water Corridor.

^ = plan rating utilised rather than method in Table 1.2.

\* = Distance calculated from records mapped in plan as coordinates not available.