maia
Environmental Consultancy

Metals X: Labouchere Survey Area (Tenements M52/5, M52/125, P52/1508, L52/172, P52/1509 and P52/1511)

Level 1 Reconnaissance and Targeted Flora Survey, September 2016




This document describes the results of a combined Level 1 flora and vegetation reconnaissance survey and targeted flora survey carried out by Maia Environmental Consultancy (Maia) over Metals X Limited's (Metals X) Labouchere Survey Area on tenements M52/5, M52/125, P52/1508, L52/172, P52/1509 and P52/1511 in the Gascoyne bioregion of Western Australia.

Photographs on front page – left to right: View of Labouchere Survey Area, *Ptilotus obovatus* flowers, view of Labouchere Survey Area, *Acacia cyperophylla* bark (all photographs taken by Maia).

Maia Environmental Consultancy Pty Ltd

ABN 25 141 503 184

PO Box 1213

Subiaco WA 6904

Document Prepared By: RH, SH and CC

Document Reviewed By: CC

Document Version: Version 1

Document Reference Number: 1607LSAV1

Date: 30 January 2017

Table of Contents

Tables

Maps

Acronyms and Abbreviations

BAM Act	*Biosecurity and Agriculture Management Act 2007*
BVA	Beard vegetation association
BVSA	Beard vegetation system association
BoM	Bureau of Meteorology
CSF	Conservation significant flora
DAFWA	Department of Agriculture and Food Western Australia
DEC	Department of Environment and Conservation
DER	Department of Environment Regulation
DMP	Department of Mines and Petroleum
DoP	Department of Planning
DotE	Department of the Environment
DotEE	Department of the Environment and Energy
DPaW	Department of Parks and Wildlife
DRF	Declared Rare Flora
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally sensitive area
EW	Environmental weed
Fl	Flowering
FlFr	Flowering and fruiting
Forma	Form
Fr	Fruiting
GAS	Gascoyne bioregion
GAS03	Augustus subregion of the Gascoyne bioregion
GDA94	Geocentric Datum of Australia 1994
GDE	Groundwater dependent ecosystem
GoWA	Government of Western Australia
GPS	Global Positioning System
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometre
LSA	Labouchere Survey Area
LS	Land system
m	Metre
Maia	Maia Environmental Consultancy Pty Ltd
Metals X	Metals X Limited
MGA50	Map Grid of Australia zone 50

mE	Metres east (easting)
mN	Metres north (northing)
mm	Millimetres
MVA	Maia vegetation association
MVT	Maia vegetation type
NSA	Nathans Survey Area
NVCP	Native Vegetation Clearing Permit
NVIS	National Vegetation Information System
P (1-4)	Priority (1 to 4) flora
PEC	Priority ecological community
RE	Range extension
sp.	Species -single
sp. indet.	Species cannot be determined, insufficient material
subsp.	Subspecies
T	Threatened flora species
TEC	Threatened ecological community
TFS	Targeted flora survey
TP	Threatened and Priority Flora list
TPFL	Threatened and Priority Flora database
VA	Vegetation association
var.	Variety
VSA	Vegetation system association
WA	Western Australia
WAH	Western Australian Herbarium
WA Herb	Western Australian Herbarium List
WAOL	Western Australian Organism List
WC Act	*Wildlife Conservation Act 1950*
WGS84	World Geodetic System 1984
WoNS	Weed of National Significance
x	Crossed with / hybrid
*****	Next to a plant name indicates a weed species
?	Queried species

Summary

Background and Methods

- Metals X Limited (Metals X) plans to start mining on its tenements at Peak Hill in the Gascoyne region of Western Australia (WA). Maia Environmental Consultancy Pty Ltd (Maia) was contracted by Metals X to carry out a combined Level 1 flora and vegetation reconnaissance survey and targeted flora survey over the project area, which is known as the Labouchere Survey Area (LSA). The LSA covers approximately 1,318 ha and it includes a buffer around the existing Labouchere pit (approximately 200 m wide), a haul road corridor approximately 5.6 km long and 40 m wide (inside the LSA and a section in the Nathans Survey Area (NSA)), and the remainder of the LSA. The survey was carried out by two botanists between October 2 and October 4, 2016.
- The LSA lies in the Mid-West administrative region of WA, in the Shire of Meekatharra, approximately 145 km north-northwest of the town of Meekatharra.

Desktop Study Results

- No threatened flora species have been located within 30 km of the LSA to date. Government database searches listed four priority (P) species with locations within 30 km of the LSA – *Eucalyptus semota* (P1), *Solanum reclusum* (P1 and endemic to the area), *Eremophila obliquisepala* and *Maireana prosthecochaeta* (both P3). Maia's database lists eight priority species with records on neighbouring tenements: *Stenanthemum mediale* (P1), *Eremophila obliquisepala*, *Homalocalyx echinulatus*, *Indigofera gilesii*, *Maireana prosthecochaeta*, *Sauropus* sp. Woolgorong (M. Officer s.n. 10/8/94), *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) and *Tribulus adelacanthus* (all P3).
- No weed species on any of the lists of national interest have been located within 30 km of the LSA. One weed species declared in the Shire of Meekatharra has been located within 30 km of the LSA – *Datura leichhardtii*. Other weeds, *Atriplex canescens*, *Bidens bipinnata* and *Citrullus colocynthis* have been located within 30 km or on neighbouring tenements.
- The LSA is not in or part of a threatened or priority ecological community (TEC or PEC). The closest buffer around a section of the Priority 1 Robinson Range vegetation complexes (banded ironstone formation) priority ecological community (PEC) lies approximately 1 km south of the end of the haul road corridor in the NSA.
- The LSA is not in a Red Book area, an environmentally sensitive area, a Schedule 1 area, is not on land managed by the Department of Parks and Wildlife (DPaW) or former leasehold land.

Survey Results - Flora

- One hundred and seventy (170) taxa from 80 genera and 34 families (73% perennial, 27% annual) were recorded in the LSA.
- No threatened species, five confirmed priority species and one potential priority species were recorded in the LSA: *Stenanthemum mediale* (P1), *Eremophila obliquisepala*, *Gunniopsis propinqua*, *Indigofera gilesii* and *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (all P3) and *I.* ?*gilesii* (?P3).
- No weed species on any of the national weeds lists or declared in WA were recorded in the LSA. Three environmental weed species were located - *Bidens bipinnata*, *Cenchrus ciliaris* and *Rumex vesicarius* and *C. ciliaris* and *R. vesicarius* are rated as having high ecological impact and rapid invasiveness; *R. vesicarius* was the most common weed recorded in the LSA.

Survey Results - Vegetation

- Eight vegetation types were mapped in the LSA: five *Acacia* shrublands (*A***SL**-1, *A***SL**-2, *A***SL**-3, *A***SL**-4 and *A***SL**-5), one *Acacia* woodland (*A***WL**-1), and two mixed shrublands (M**SL**-1 and M**SL**-2). The

dominant vegetation types were *A***SL**-1 and *A***SL**-2, mapped over approximately 23% and 45% of the LSA respectively. The condition of the vegetation in the LSA was rated as either pristine or nearly so (2) (approximately 89% of the LSA), or having slight to obvious signs of damage since European settlement (3) (approximately 3% of the LSA). The remainder (approximately 8%) was mapped as disturbed.

Ecological Communities

- The LSA does not lie in an area mapped as a threatened or priority ecological community (TEC or PEC).

Groundwater Dependent Ecosystems, Sheet Flow and Runoff

- Some of the species located along the larger creek lines of the LSA, particularly the trees and larger shrubs, are likely to use groundwater at least some time during the year. The closest of these creek lines is approximately 1.0 km away from the centre of the existing Labouchere pit.

Conservation Significance

- One of the five confirmed/potential priority species located in the LSA is a P1 and four are P3/potential P3 species. One of the five species is rated as having high local significance (*Stenanthemum mediale*), one as moderate to high (*Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362)), one as moderate (*Indigofera gilesii*/*Indigofera ?gilesii*) and two as low (*Eremophila obliquisepala* and *Gunniopsis propinqua*). *T.* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) will not be directly impacted by any vegetation clearing within the pit buffer and haul road corridor (i.e. zero local impact). The local impact estimated for two species, *S. mediale* and *Indigofera gilesii*/*Indigofera ?gilesii*, is 100% while the local impact to *E. obliquisepala* and *Gunniopsis propinqua* is less than 5%. Given the relatively small area surveyed in the non-impact areas (approximately 5%) it is also likely that more plants of each of these species occur in the LSA and that the local impacts will be lower than those calculated.
- The eight vegetation types mapped in the LSA appear to be locally common, they occur in the surrounding areas and are rated as having either moderate (*A***SL**-2, *A***SL**-3, *A***SL**-4, *A***SL**-5 and M**SL**-1) or low (*A***SL**-1, *A***WL**-1 and M**S**L-2) local significance. Highest impact estimated for the vegetation types mapped in the LSA is 100% to M**S**L-2. However, this impact is calculated using the area of M**S**L-2 that occurs in the LSA only and not using the area that was mapped in the NSA; when the 26.25 ha mapped in the NSA is used to calculate impact it is less than 1%. Impact to *A***SL**-5 will be approximately 16%, to *A***SL**-3 approximately 8%, to *A***SL**-1 and *A***SL**-2 approximately 4% and impact to the remaining vegetation types will be less than 1% (*A***SL**-4, *A***WL**-1 and M**S**L-1).

Recommendations

- Direct impact to the priority species located in the LSA should be avoided or minimised whenever possible; particularly to the P1 species *Stenanthemum mediale*.
- As *Stenanthemum mediale* is a P1 species and it was located only in areas that could be cleared for the proposed works a follow-up targeted survey might be required to find more plants within the LSA but away from the impact areas to more accurately define local impacts to this P1 species. However, it has been located on a neighbouring tenement (E52/1671; seven plants).
- Direct impact to the vegetation of the LSA should be minimised as much as possible and clearing boundaries clearly marked to achieve this aim.
- Every effort should be made to prevent a) the introduction of new weeds into the area on machinery used for the earth works, and b) the spread of existing weeds into the surrounding area when soil and rock is moved from place to place.

Metals X: Labouchere Survey Area (Tenements M52/5, M52/125, P52/1508, L52/172, P52/1509 and P52/1511)

Level 1 Reconnaissance and Targeted Flora Survey, September 2016

1 Introduction

1.1 Scope of Work

Metals X Limited (Metals X) plans to carry out mining activities on tenements M52/5, M52/125, P52/1508, L52/172, P52/1509 and P52/1511 (DMP, 2017; **Map 9.1, Section 9**) in the Gascoyne region of Western Australia (WA).

Maia Environmental Consultancy Pty Ltd (Maia) was contracted by Metals X to carry out a combined Level 1 flora and vegetation reconnaissance survey and targeted flora survey (TFS) over the area, which is known as the Labouchere Survey Area (LSA) (**Map 9.1, Section 9**).

This report presents the results of a brief desktop study carried out before going to site, the results of the field survey, and a discussion of the significance of the flora and vegetation of the LSA.

While at site Maia also carried out a Level 1 flora and vegetation reconnaissance survey and TFS at Metal X's Nathans project area – the Nathans Survey Area (NSA) (**Map 9.1, Section 9**). A section of haul road leading from the Labouchere project area and joining with the haul road close to the pit in the Nathans project area lies in the NSA and the results for this section of haul road are also included in this report.

1.2 Survey Area Location and Size

The LSA lies in the Mid-West administrative region of WA, in the Shire of Meekatharra, and is located approximately 145 kilometres (km) north-northwest of the town of Meekatharra (**Map 9.1, Section 9**).

The LSA covers approximately 1,318 hectares (ha) and comprises:

- A buffer around the existing Labouchere pit – approximately 200 metres (m) wide;
- A haul road corridor extending from the Labouchere pit to the eastern boundary of the LSA – approximately 4.40 km long and 40 m wide;
- A section of haul road corridor extending from the eastern boundary of the LSA to the NSA haul road corridor - approximately 1.18 km long and 40 m wide; and,
- The remainder of the LSA.

2 Background Information

2.1 Bioregional and Physical Setting

Information on the bioregion, sub-region, geology, soil landscape units, pre-European vegetation associations, land systems, the main findings of any earlier surveys carried out in or in the vicinity of the LSA (including priority species, and introduced species (weeds)), groundwater dependent ecosystems (GDE), sheet flow dependent vegetation, environmentally sensitive areas (ESA), conservation estate, Schedule 1 areas, former leasehold areas, Environmental Protection Authority (EPA) Red Book areas and significant water bodies rivers and drainage lines and any other significant ecosystems is summarised in **Table 2.1**. Information on the database searches carried out, and on the conservation significant flora (CSF) species, weed species, threatened or priority ecological communities (TEC or PEC) in the database search results is also presented in this section.

Table 2.1: Background information

Background information on the Survey Area	
Bioregion and subregion (**Map 9.2, Section 9**)	Gascoyne bioregion (GAS) and Augustus subregion (GAS03) (Department of the Environment and Energy (DotEE), 2016a).
Geology (**Map 9.3, Section 9**)	The surface geology of the LSA is mapped as six units (Stewart *et al*., 2008): • Basalt with local pillow structures and hyaloclastite, dolerite sills which are commonly rhythmically layered, peridotite, pyroxenite, and leuco- meso- and melano-gabbro; mafic and ultramafic schist, minor jasperoidal chert, and local volcaniclastics (Cza). • Sandstone, greywacke and shale; conglomerate lenses in upward-fining cycles; metamorphosed in places to quartz(-mica) schist (Lspl). • Conglomerate with sandstone matrix, sandstone, siltstone, commonly graded; chert, chlorite rock, metasiltstone and phyllite (Lspw). • Mafic and ultramafic talc-chlorite-tremolite schist, metamorphosed pyroxenite, peridotite, picrite and komatiitic basalt, with local olivine cumulates; commonly carbonated, silicified or serpentinised (Lubn). • Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite (Qrc).

Background information on the Survey Area	
Soil landscape units	The LSA lies in the Ashburton Province of the Western Region (Tille, 2006). The Ashburton Province is mapped between Onslow, Gascoyne Junction, Meekatharra, Wiluna, Jigalong, Newman, Paraburdoo and Pannawonica and extends to the south-east between Jigalong and Wiluna. It is described as hills and ranges (with stony plains and hardpan wash plains) on the sedimentary and granitic rocks of the Capricorn Orogen. The Ashburton Province is divided into nine soil-landscape zones and LSA lies within the Gascoyne Valley zone (295), which is located in the Upper Gascoyne between Landor Station and the Great Northern Highway. The Gascoyne Valley zone is described as hardpan wash plains (with hills, stony plains and some calcrete plains and floodplains) on alluvial deposits over gneiss and volcanic rocks of the southern parts of the Gascoyne Complex and Edmund and Collier Basins (Tille, 2006). The soils are Red-brown hardpan shallow loams with Red deep sands, Red shallow sandy duplexes and Red loamy earths and some Red/brown non-cracking clays and Stony soils. The vegetation is described as Mulga shrublands (with some wanderrie grasses and chenopods) (Department of Agriculture and Food, WA (DAFWA), 2016a).
Pre-European vegetation associations and system associations (**Map 9.4, Section 9**)	The LSA is located in Beard's Gascoyne physiographic region in the Ashburton Botanical District of the Eremaean Province of WA. One of Beard's vegetation associations (VA) and system associations (VSA) occur in the LSA (DAFWA, 2012a): • VA 18, VSA 18.5 - description – Low woodland; mulga (*Acacia aneura*). The pre-European and current extent of the vegetation association and vegetation system association in the Gascoyne IBRA region overall is listed in **Table 2.2** along with the amount in reserves and the prioritisation for reservation of the association in the Augustus subregion.
Land systems (**Map 9.5, Section 9)**	The LSA lies over three land systems (DAFWA, 2014): • Augustus - Rugged ranges, hills, ridges and plateaux supporting mulga shrublands in southern parts or hard spinifex grasslands in northern most parts. • Beasley - Low ridges, hills and lateritised residuals above stony footslopes and broad, stony lower plains supporting scattered mulga and snakewood-dominated shrublands. • Jamindie - Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey.
Previous botanical surveys carried out in the vicinity of the Labouchere Survey Area	**Robinson Range**: 50 quadrats across the range; Level 2 flora and vegetation assessment (Meissner *et al.*, 2009). **Fortnum1:** M52/98, M52/99, M52/96, M52/95 (the areas surveyed now comprise M52/132), M52/93, M52/92 and E52/42 (currently M52/133 and E52/1659); Level 1 vegetation, flora and fauna assessment (Dames & Moore, 1988). **Fortnum2:** M52/132, M52/133, M52/85, M52/96, M52/99; Level 1 flora and vegetation assessment (Umwelt, 2012). **Horseshoe**: M52/251, M52/338 and L52/102; Level 1 flora and fauna survey (Umwelt, 2013). **Fortnum3**: E52/1659 and E52/1671; Level 1 flora and vegetation assessment (Maia, 2015). **Nathans**: M52/95, M52/96, M52/98, M52/99 and P52/1510; Level 1 flora and vegetation assessment (Maia, 2016).

Background information on the Survey Area	
Conservation significant species located during previous botanical surveys carried out in the vicinity of the Labouchere Survey Area	**Robinson Range**: Two priority (P) flora species listed at the time of the survey – *Euphorbia sarcostemmoides* (P1) and *Baeckea* sp. Melita station (which is no longer listed as a priority flora species). Two new species discovered – *Pityrodia iphthima* (P1) and *Indigofera fractiflexa* subsp. *augustensis* (P2). Several taxa of taxonomic interest were collected during the survey and one of these has since been listed as a priority species: *Halgania gustafsenii* var. Murchison (R. Meissner & B. Bayliss 743) (P1) (Meissner *et al.*, 2009). **Fortnum1:** no CSF species were located, however potential for unusual or rare species in the hilly areas was noted (Dames & Moore, 1988). **Fortnum2:** no CSF species were located (Umwelt, 2012). **Horseshoe**: no CSF species were located (Umwelt, 2013). **Fortnum3**: Eight priority species - *Stenanthemum mediale* (P1), *Eremophila obliquisepala* (P3), *Homalocalyx echinulatus* (P3), *Indigofera* sp. Gilesii (M.E. Trudgen 15869) (P3; has since been renamed *Indigofera gilesii*), *Maireana prosthecochaeta* (P3), *Sauropus ramosissimus* (P3; now called *Sauropus* sp. Woolgorong (M. Officer s.n. 10/8/94)), *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3) and *Tribulus adelacanthus* (P3). One potentially significant taxon was also collected from the area – *Eremophila* sp. Mt Beasley ((S. Hitchcock SH1182) (Maia, 2015). **Nathans**: Seven priority species - *Eremophila lanata* (P3), *E. obliquisepala* (P3), *Gunniopsis propinqua* (P3), *Indigofera gilesii* (P3), *Sauropus* sp. Woolgorong (M. Officer s.n. 10/8/94) (P3), *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3) and *Goodenia berringbinensis* (P4) (Maia, 2016).
Introduced species (weeds) located during previous botanical surveys carried out in the vicinity of Labouchere Survey Area	**Robinson Range**: One weed species – *Cuscuta epithymum* (Lesser Dodder) (Meissner *et al.*, 2009). **Fortnum1:** No weed species were located (Dames & Moore, 1988). **Fortnum2:** One weed species – *Bidens bipinnata* (Bipinnate Begger's Tick) (Umwelt, 2012). **Horseshoe**: No weed species were located (Umwelt, 2013). **Fortnum3**: Two weed species - *Bidens bipinnata* (Bipinnate Begger's Tick) and *Citrullus colocynthis* (Colocynth) (Maia, 2015). **Nathans**: Seven environmental weed species were located - *Argemone ochroleuca* subsp. *ochroleuca* (Mexican Poppy), *Bidens bipinnata*, *Cenchrus ciliaris*, *Lysimachia arvensis*, *Malvastrum americanum*, *Rumex vesicarius* and *Sonchus oleraceus* (Maia, 2016). These weed species are not on any of the national weeds lists or listed as a declared pest in WA.
Environmentally sensitive areas (ESA), conservation estate, Schedule 1, Former Leasehold and EPA Red Book areas (**Map 9.6, Section 9**)	The closest ESA and schedule 1 area is 27 km south-east of the centre of the LSA and is likely to be a Threatened Flora buffer or heritage area. The closest Department of Parks and Wildlife (DPaW) managed land is approximately 72 km north-east of the centre of the LSA (Collier Range National Park), the closest former leasehold land is approximately 58 km to the south-east (ex Doolgunna) and the closest EPA Red Book area is approximately 71 km away (area beyond the boundary of the Collier Range National Park and referred to as the 'Collier Range Area'). Source: DPaW (2014, 2016a), Department of Environment Regulation ((DER; 2014, 2015).
Other ecosystems at risk	Plant assemblages of Robinson Range is listed as an ecosystem at risk (Desmond, Kendrick and Chant, 2001). This is the equivalent of the 'Robinson Range vegetation complexes (banded ironstone formation)' Priority 1 PEC. The boundary of this PEC does not lie over the LSA (DPaW ecological communities search reference # 14-0916EC).

Background information on the Survey Area	
Significant water bodies, rivers and drainage lines	No Ramsar wetland, wetlands on the Directory of Important Wetlands or Aboriginal Settlement Wetlands occur in or close to the LSA. The Gascoyne River is 11 km to the north of the LSA and a few smaller ephemeral drainage lines cross the LSA. Source: DotE (2010), DotEE (2016b), Department of Planning (DoP, 2016), Geoscience Australia
Sheet flow dependent vegetation	No banded mulga occurs in the LSA.
Groundwater dependent ecosystems (GDE) - subsurface	There are no GDE reliant on subsurface groundwater (vegetation) currently known to occur in the LSA (**Figure 2.1**).  **Figure 2.1: GDE reliant on subsurface groundwater (vegetation)** Source: BoM (2016a). Approximate location of the LSA added by Maia.

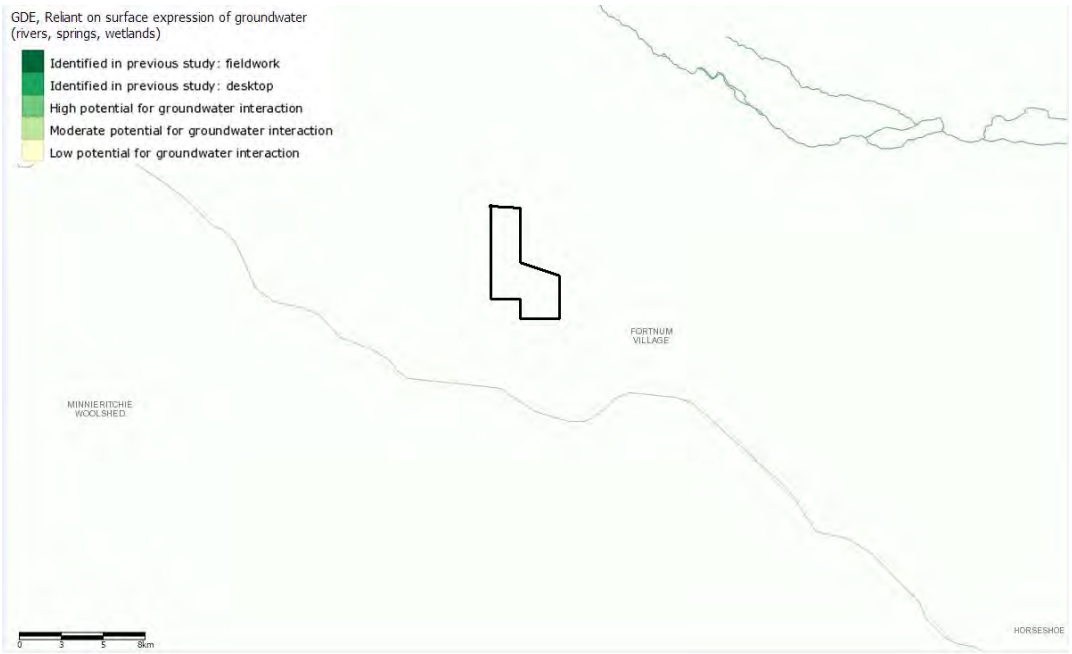
Background information on the Survey Area	
Groundwater dependent ecosystems (GDE) - surface	No GDE reliant on surface expression of groundwater (rivers, springs, wetlands) is currently known to occur in the LSA (**Figure 2.2**).  **Figure 2.2: GDE, reliant on surface expression of groundwater (rivers, springs, wetlands)** Source: BoM (2016a). Approximate location of the LSA added by Maia.

Table 2.2: Beard's Pre-European vegetation associations and system associations in the Labouchere Survey Area

Vegetation association/system association (DAFWA, 2012a)	Broad floristic formation	Pre-European extent (ha) in Gascoyne bioregion	Current Extent (ha) in Gascoyne bioregion	Remaining in Gascoyne bioregion (%)	Current Extent Protected (IUCN 1-4) for Conservation (proportion of pre-European extent) in Gascoyne bioregion (%)	Prioritisation for Reservation of Ecosystem in the Augustus subregion (Desmond, Kendrick and Chant, 2001)
Vegetation association						
18	*Acacia* woodland	3,273,579.71	3,271,339.12	99.93	2.49	Medium
Vegetation system association						
18.5	*Acacia* woodland	1,794,574.68	1,793,132.31	99.92	0.91	Not assessed at system association level

Source: Government of Western Australia (2015), unless noted otherwise.

2.2 RAINFALL

The closest Bureau of Meteorology (BoM) weather stations to the LSA are Meekatharra Airport (BoM Station Number 7045) located approximately 150 km south of the LSA and Mount Padbury (BoM Station Number 7100) located approximately 48 km south south-west of the LSA.

Long-term (all records and 10 years) and 2016 monthly total rainfall data from both stations from January to September are listed in **Table 2.3** along with the total rainfall for those nine months.

The highest long-term (all records and 10 years) average total monthly rainfall is recorded in January, February, March or June. August and September are typically the driest months (**Table 2.3**) (BoM, 2016b).

Rainfall received between January and September 2016 (199.6 millimetres (mm) and 143.1 mm at Meekatharra and Mount Padbury respectively) was lower than the all records long-term mean and higher than the 10 year long-term mean at both stations (**Table 2.3**).

Total rainfall recorded at Meekatharra in the three months before the survey (July, August and September – 43.6 mm) was higher than the all records (36.5 mm) and 10 year (26.5 mm) long-term means for those three months (**Table 2.3**).

Total rainfall recorded at Mount Padbury in the three months before the survey (July, August and September – 23.0 mm) was lower than the all records long-term mean (31.9 mm) and higher than the 10 year (10.4 mm) long-term means for those three months (**Table 2.3**).

Rainfall received in the survey area was likely somewhere between the rains received at Meekatharra Airport and at Mount Padbury and the vegetation could be expected to have been in average to above average condition.

Table 2.3: Actual (2016) and long-term (all records and last 10 years) monthly rainfall (mm) at Meekatharra Airport and Mount Padbury (BoM, 2016b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan to Sep tot
Rainfall (mm) records for Meekatharra Airport (Station Number 7045)													
2016	**11.2**	**34.2**	**42.4**	**7.6**	**19.6**	**41.0**	**32.4**	**9.8**	**1.4**				**199.6**
L-t$^{44\text{-}16}$	29.5	36.3	29.4	19.2	22.7	30.1	21.1	10.8	4.6				203.7
L-t$^{07\text{-}16M}$	39.4	43.5	32.3	7.9	12.0	19.6	15.7	7.2	3.6				181.0
Rainfall (mm) records for Mount Padbury (Station Number 7100)													
2016	**9.0**	**65.0**	**19.0**	**18.1**		**9.0**	**23.0**						**143.1**
L-t$^{02\text{-}16}$	34.4	34.5	33.6	21.6	20.8	26.6	20.6	8.7	2.6				203.4
L-t$^{07\text{-}16P}$	25.4	55.0	21.3	11.0	5.6	7.4	5.9	3.5	1.0				136.1

Note: L-t$^{44\text{-}16}$ = long-term 1944-2016 Meekatharra; L-t$^{07\text{-}16M}$ = long-term 2007-2016 Meekatharra; L-t$^{02\text{-}16}$ = long-term 1902-2016 Mount Padbury; L-t$^{07\text{-}16P}$ = long-term 2007-2016 Mount Padbury; gaps in the rainfall data are either because no rainfall was recorded in that month, the observer was not available (where observations are undertaken manually), a failure in the observing equipment, or when an event has produced suspect data. These data have not been fully quality controlled (BoM, 2016b).

BoM's rainfall deciles map for 1 July to 30 September 2016 (**Figure 2.3**) shows that the LSA lies in an area that received above average/very much above average rainfall over those three months (BoM, 2016c).

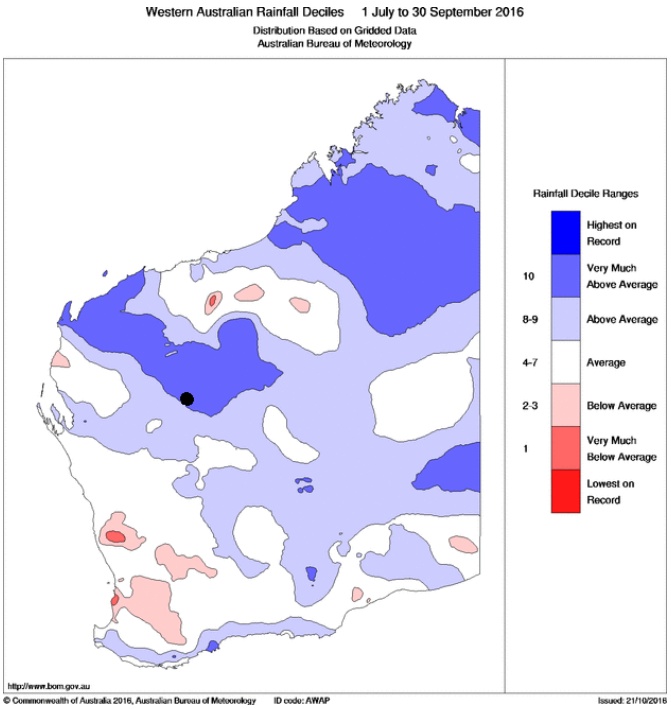


Figure 2.3: Western Australian rainfall deciles, 1 July to 30 September 2016 (BoM, 2016c)

2.3 Database Searches Carried Out

Information on the flora species and ecological communities occurring in the LSA was also gathered from the sources listed in **Table 2.4**. The area over which these searches were carried out is shown on **Map 9.7 (Section 9)**.

Table 2.4: Databases used/searched

Database	Reference or reference number	Buffer(s) (km)
EPBC Act Protected Matters Search Tool	DotEE (2016c)	30
Department of Parks and Wildlife's (DPaW) NatureMap	DPaW (2007-)	30
DPaW 's Threatened and Priority Flora database (TPFL)	DPaW (2016b, Reference #22-0916FL)	30
DPaW 's Threatened and Priority Flora List (TP List)	DPaW (2016b, Reference #22-0916FL)	30
The Western Australian Herbarium (WA Herb)– for Threatened and Priority flora species opportunistically collected in the area of interest (DPaW, 2016c)	DPaW (2016b, Reference #22-0916FL)	30
DPaW 's Threatened Ecological Communities database	DPaW (2016c, Reference # 14-0916EC)	30
Co-ordinates used for EPBC Act and NatureMap searches: 25^0 20' 52" S and 118^0 22' 45" E. The search results are included as **Figures A1.1 to A1.2 (Appendix 1)**. **DPaW Threatened Flora searches:** See the search area map (**Map 9.7, Section 9)**) for the boundary used. **DPaW Threatened Ecological Community search:** See the search area map (**Map 9.7, Section 9)**) for the boundary used.		

The following lists were searched/referenced to determine whether any weeds identified in the EPBC Act Protected Matters and NatureMap searches and in the results of previous surveys carried out within the database search boundary were any of the following (Australian Government, 2016):

- Weeds of National Significance (WoNS);
- On the National Environmental Alert List;
- On the Sleeper Weed List;
- A Species Targeted for Eradication;
- A Species Targeted for Biological Control; or
- A Declared Pest (plant) in WA (DAFWA, 2016b).

2.4 Database Search Results

The results of the database searches are discussed in the following sections. **Table A1.1 (Appendix 1)** lists the CSF species produced by the searches and also from Maia's database. **Map 9.8 (Section 9)** shows the locations of CSF species within the database search area and **Map 9.9** conservation significant ecological communities.

2.4.1 Threatened Flora

2.4.1.1 Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Some flora species are protected by Australian Government legislation based on the perceived levels of threat to the species population at a national level. These species are placed within one of six conservation categories **(Table A2.1, Appendix 2)** and four of these categories are specially protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (DotEE, 2016d).

- The results of a search carried out using the EPBC Act Protected Matters Search Tool (DotEE, 2016c) listed one Endangered species, or species habitat, protected by the EPBC Act as likely to occur within the database search area (**Table A1.1, Appendix 1**) – *Pityrodia augustensis* (Vulnerable). This species was also listed in the Threatened and Priority Flora List (TP List) search results; however, the species was not in the WA Herbarium (WA Herb) results and there were no Threatened (Declared Rare) and Priority Flora (TPFL) database results therefore this species has not been recorded within the database search area to date.

2.4.1.2 Western Australian *Wildlife Conservation Act 1950*

In WA a number of species are protected by the *Wildlife Conservation Act 1950* (WC Act) the term Threatened Flora is applied to extant Declared Rare Flora (DRF) and Presumed Extinct Flora to presumed extinct DRF. These species are listed under Schedule 1 and 2 of the WC Act and the most recent threatened flora/DRF list was published on January 6, 2017 (Government of WA (GoWA), 2017). Extant threatened flora species can be listed as critically endangered, endangered or vulnerable (DPaW, 2015 and defined in **Table A2.2, Appendix 2**).

- At the time of writing this report, three threatened flora species are listed as occurring in the Gascoyne bioregion (Western Australian Herbarium (WAH), 1998-) – *Pityrodia augustensis* (Vulnerable), *Aluta quadrata* (Endangered) and *Thryptomene wittweri* (Vulnerable). No TPFL results were produced for the database search area, and these species were not listed in the WA Herb results therefore these species have not been recorded within the database search area to date.

- No threatened species protected by the WC Act were listed in the NatureMap search results (DPaW, 2007-).

- The TP List search results listed four threatened species (**Table A1.1, Appendix 1**); however, these species were not listed in the WA Herb results and there were no TPFL results and therefore these species have not been recorded within the database search area to date.

2.4.2 Priority Flora

Because of the large WA flora, many species are known from only a few collections, or a few sites, and have not been adequately surveyed or are adequately known are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened list for other than taxonomic reasons and these species can be placed on a priority species list (listed as Priority 1 to 4). Categories and definitions for priority flora species are included in **Table A2.3 (Appendix 2)**.

The most recent Priority Flora List was published on November 11, 2015 (Jones, 2015).

- In January 2017, 104 priority flora species were listed on FloraBase as occurring in the Gascoyne bioregion and 70 of these 104 species occur in the Augustus subregion (WAH, 1998-).
- The NatureMap search over the database search area listed four priority species with records in the area – *Eucalyptus semota* (P1), *Solanum reclusum* (P1 and endemic to the area), *Eremophila obliquisepala* (P3) and *Maireana prosthecochaeta* (P3).
- The DPaW WA Herb search results also listed these four species as occurring in the area (**Table A1.1, Appendix 1**; **Map 9.8, Section 9).**
- The TP List results included 60 priority flora species with records in the surrounding bioregions and that could be used as a species target list. Three of these 60 species have been located within the database search area as there are WA Herb records for them (*Solanum reclusum*, *Eremophila obliquisepala* and *Maireana prosthecochaeta***; Table A1.1, Appendix 1)**.
- Maia's database search results indicated that eight priority species were located when surveys were carried out on neighbouring tenements: *Stenanthemum mediale* (P1), *Eremophila obliquisepala* (P3), *Homalocalyx echinulatus* (P3), *Indigofera gilesii* (P3), *Maireana prosthecochaeta* (P3), *Sauropus* sp. Woolgorong (M. Officer s.n. 10/8/94) (P3), *Thryptomene sp. Leinster* (B.J. Lepschi & L.A. Craven 4362) (P3) and *Tribulus adelacanthus* (P3) (**Table A1.1, Appendix 1**; **Map 9.8, Section 9)**.

2.4.3 Introduced Flora

2.4.3.1 WEEDS OF NATIONAL SIGNIFICANCE

A number of lists of weeds of national interest are currently recognised (e.g. weeds of national significance, WoNS). The nature of the weeds and the resulting actions required for their control determine on which list a weed species may appear. Some weeds are of particular concern and, as a result, have been listed for priority management or in legislation. The weed lists are available on the Australian Government's website (Australian Government, 2016). These lists are: WoNS, National Environmental Alert, Sleeper Weeds, Six Species Targeted for National Eradication and Species Targeted for Biological Control.

- No weed species (or the potential habitat) on any of these weeds lists were listed in the EPBC Act Protected Matters Search Tool results (DotEE, 2016c) (**Figure A1.1, Appendix 1**).
- No weed species on any of these weeds lists were listed in the results of the NatureMap search carried out over the database search area (DPaW, 2007-) (**Figure A1.2, Appendix 1**).

2.4.3.2 PLANT PESTS DECLARED IN WESTERN AUSTRALIA

To protect WA agriculture DAFWA regulates harmful plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DAFWA, 2016b). Under the BAM Act all declared pests are placed in one of three categories and these are explained in **Table A3.1, Appendix 3** (DAFWA, 2016c).

- No declared pest plants were listed in the results of the EPBC Act Protected Matters Search Tool search (DotEE, 2016c) (**Figure A1.1, Appendix 1**).
- Two declared pest plants were listed in the results of the NatureMap search (DPaW, 2007-; **Figure A1.2, Appendix 1**) – *Heliotropium europaeum* (Common Heliotrope) and *Datura leichhardtii* (Native Thornapple). Common Heliotrope is a C3 – Management pest in the southwest of WA but not in the Shire of Meekatharra. Native Thornapple is a C3 - Management pest for most of the state including in the Shire of Meekatharra (DAFWA, 2016d).

2.4.3.3 ENVIRONMENTAL WEEDS

- The EPBC Protected Matters Search Tool (DotEE, 2016c) search results listed one weed species or its potential habitat as likely to occur in the database search area – *Cenchrus ciliaris* (Buffel-grass) (**Figure A1.1, Appendix 1**).
- The NatureMap search results (DPaW, 2007-) listed a fourth weed species with records in the search area – *Atriplex canescens* (Fourwing Saltbush) (**Figure A1.2, Appendix 1**).

DPaW prioritises weeds in each region based on their invasiveness, ecological impact, potential and current distribution and feasibility of control. The resulting priorities focus on weeds considered to be high impact, rapidly invasive and still at a population size that can feasibly be eradicated or contained to a manageable size. Summaries of the species' ecological impact and invasiveness rankings are provided to help landholders, community groups and private enterprises manage weeds that might impact on the natural environment (DPaW, 2016d). Current regional impact and invasiveness ratings for the different regions are available on DPaW's website (DPaW, 2016e).

DPaW suggests that priorities regarding weeds are:

1. Early Detection/Rapid Response; Any new infestations and/or introductions of any weed species in an area, no matter their impact and/or invasiveness, should be eradicated immediately;
2. Eradication of those species which are still in small enough populations for this target to be achieved; and,
3. Management of high impact, rapidly-moderately invasive species that are impacting on high value conservation assets (DPaW, 2016e).

The Midwest region impact and invasiveness ratings (DPaW, 2016e) for the weed species listed in the search results are presented in **Table 2.5**.

Table 2.5: Weed species listed in database search results

Taxa	Rank	DPaW Ecological impact	DPaW Invasiveness	Search
Atriplex canescens (Fourwing Saltbush)	General weed, not ranked	Unknown	Unknown	NM
Cenchrus ciliaris (Buffel-grass)	General weed, not ranked	High	Rapid	EPBC
Datura leichhardtii (Native Thornapple)	A pest in some areas of WA, but not in the Shire of Meekatharra	High	Rapid	NM
Heliotropium europaeum (Common Heliotrope)	C3 Management for most of WA including in the Shire of Meekatharra	Low	Rapid	NM

Note: NM = NatureMap (DPaW, 2007-); EPBC = EPBC Act Protected Matters Search Tool (DotEE, 2016c).

2.4.4 Threatened and Priority Ecological Communities

Some ecological communities are protected by Australian Government legislation (the EPBC Act) based on the perceived levels of threat to the community or species population at a national level. They are listed as threatened ecological communities – TECs – and can be listed as Critically Endangered, Endangered or Vulnerable (**Table A2.4, Appendix 2**).

Some TECs are listed as significant under the WC Act. The WA Minister for Environment may list an ecological community as being threatened if the community is presumed to be totally destroyed or at risk of becoming totally destroyed (**Table A2.5, Appendix 2**). Ecological communities with insufficient information available to be considered a TEC, or which are rare but not currently threatened, are placed on a Priority list and are referred to as priority ecological communities (PECs; listed as Priority 1 to 5) (**Table A2.6, Appendix 2**).

The most recent WA TEC list is correct to October 6, 2016 and no TECs are listed for the Gascoyne bioregion (DPaW, 2016g).

The most recent PEC list is dated November 30, 2016 (DPaW, 2016f) and includes 109 PECs listed in DPaW's Midwest region.

- No federally protected TECs were listed in the EPBC Act Protected Matters Search (DotEE, 2016c) as likely to occur within 30 km of the LSA (**Figure A1.1, Appendix 1**).
- No TECs were listed in the results of the DPaW ecological community search carried out over the database search area (DPaW, 2016c; search reference number 14-0916EC).
- Four PECs were listed in the results of the DPaW ecological community search carried out over the database search area (DPaW, 2016c; search reference number 14-0916EC) (**Map 9.9, Section 9**).
- The four PECs occur outside of but in the vicinity of the LSA: 1) Robinson Range vegetation complexes (banded ironstone formation) Priority 1 PEC (one mapped area approximately 4 km east of the centre of the LSA and a second approximately 1 km south of the end of the Labouchere haul road in the NSA); 2) Milgun central calcrete groundwater assemblage types on Gascoyne palaeodrainage on Milgun Station (Priority 1 PEC) (approximately 12 km north north-east of the centre of the LSA); 3) Milgun south calcrete groundwater assemblage types on Gascoyne palaeodrainage on Milgun Station (Priority 1 PEC) (approximately 12 km north-west of the centre of the LSA); and, 4) Three Rivers Plutonic calcrete groundwater assemblage types on Gascoyne palaeodrainage on Three Rivers Station (Priority 1 PEC) (approximately 26 km north-east of the centre of the LSA) (**Map 9.9, Section 9**). The last three PECs do not relate to the flora and vegetation of the area.

3 METHODS – SURVEY, TAXONOMY AND VEGETATION MAPPING

3.1 FIELD SURVEY METHODS

The survey methodology was developed to comply with the following:

- Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA and DPaW, 2015).
- Guidance for the Assessment of Environmental Factors (in accordance with the Environmental Protection Act 1986), Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia, No. 51, (EPA, 2004); and
- Terrestrial Biological Surveys as an element of Biodiversity Protection, Position Statement No. 3 (EPA, 2002).

The survey was carried out over the LSA by two botanists between October 2 and 4, 2016 (five botanist days were spent in the LSA over these three days i.e. two botanists spent 2.5 days surveying the LSA).

Before undertaking the survey the botanists familiarised themselves with the CSF species and ecological communities produced by the database and literature searches.

CSF species known to occur in the area and surrounds, any novel species and introduced species were targeted while walking. Each botanist surveyed a band of vegetation approximately 15 m wide while walking traverses in the LSA. The botanists surveyed a band of vegetation of approximately 15 m wide on both sides of the existing track that is proposed to be used as the haul road (sections of the haul road inside the LSA and also inside the NSA).

In order to map the vegetation of the LSA the botanists assessed the flora and vegetation at 38 relevé sites. Relevé locations were chosen before the survey using aerial imagery and LSA boundaries. Relevés were placed to capture each habitat visible on the aerial imagery and the pre-European vegetation and land systems of the LSA. The final location for the relevés was selected by the botanists while carrying out the survey. The following parameters were recorded at each relevé site:

- Location details including Global Positioning System (GPS) co-ordinates (Geocentric Datum of Australia 1994 (GDA94)).
- Site parameters such as soil description, topography and general habitat description, rock type and cover.
- A photograph of the site.
- Vegetation condition using the scale and criteria indicated in EPA and DPaW (2015).
- Notes on any disturbance to the vegetation.
- Fire history.
- A description of the vegetation structure including the height, percentage cover and dominant species within each stratum.
- The name, height, percentage cover and any other significant recording details for any other species located at the relevé.

While walking traverses over the LSA, the botanists also recorded information when any apparently different vegetation types were encountered. In these areas the following information was collected:

- Notes on the vegetation types of the area including any changes in habitat. (These notes were used to help define vegetation type boundaries when mapping the vegetation of the LSA.)

- Changes in vegetation condition and notes on any disturbance to the vegetation.
- Changes in landform, rock type and soil type.
- Any taxa not already collected at the relevé sites.

While walking the botanists also recorded the locations of any unknown species, suspected CSF or weed species encountered. Counts or population estimates (when populations were large) for these species were also recorded.

Three hundred and eighty-one (381) specimens were collected by the botanists from the Nathans and Labouchere survey areas. A specimen of most species encountered during the survey was collected. As the botanists have a number of years of experience of the flora and vegetation of the Murchison and Gascoyne bioregions and particularly the Robinson Range area, some of the more common species known to the botanists were not collected.

3.2 Taxonomy and Nomenclature

Plant specimens collected from the LSA were identified by Cate Tauss using taxonomic keys and reference specimens at the WA Herbarium. Specialists at the WA Herbarium were consulted as necessary.

Barbara Rye, WA Herbarium Myrtaceae specialist, helped with the determination of the *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) specimens.

Species names used in this report are those adopted by the WA Herbarium and they have been checked against current FloraBase records (WAH, 1998 -). Undescribed taxa are referred to in the report and listed in the species list as “sp.” (species), subspecies as subsp. and varieties as var..

3.3 Vegetation Type Mapping

Bing aerial photography (Microsoft Corporation, 2016) captured in December 2014 was used to map the vegetation types at a scale of 1:30,000. Vegetation types were described according to the dominant species in each structural class. Notes made by the botanists while carrying out the survey were used to delineate the boundaries of each type. Statistical analyses were not carried out to define the vegetation types of the area surveyed.

Vegetation types are described using the current National Vegetation Inventory System (NVIS) methodology at the association level (Level 5). At this level up to three strata and a maximum of three taxa per stratum are used to describe an association (Executive Steering Committee for Australian Vegetation Information (ESCAVI), 2003). The NVIS structural formation terminology is outlined in **Appendix 5**; it utilises growth forms (**Table A5.1, Appendix 5**), height classes (**Table A5.2, Appendix 5**) and foliage cover characteristics (**Table A5.3, Appendix 5**).

3.4 Vegetation Condition Mapping

Vegetation condition was mapped using data collected from relevés and notes recorded while walking from site to site. Field assessments of vegetation condition were updated as necessary once the plant identifications had been confirmed and the number, ecological impact and invasiveness ratings of the weed species determined (DPaW, 2016e). The vegetation condition scale used is that for the Eremaean and Northern Botanical Provinces indicated in EPA and DPaW (2015) and included in **Table 3.1**.

Table 3.1: Vegetation condition scale (EPA and DPaW, 2015)

Vegetation condition	Eremaean and Northern Botanical Provinces
1	
2	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
3	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.
4	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.
5	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
6	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.
7	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.

3.5 Impact Calculations

Impacts included in tables and text in the Results and Discussion sections are calculated using the total area of the buffer around the existing pit and an approximately 40 m wide corridor over the existing haul road. It is unlikely that the whole of these areas will be cleared for the project and therefore the calculations are the maximum impacts that could be expected from the project.

Impacts estimated for the CSF species located and vegetation types mapped in the LSA include the section of haul road corridor outside the LSA.

Impacts to the CSF of the LSA from the project are estimated using the number of plants located at the relevés assessed and along traverses walked. While approximately 30% of the pit buffer and 100% of the haul road corridor was assessed (both inside the LSA and NSA), only a small percentage (approximately 5%) of the surrounding area in the LSA was assessed via traverses. Therefore the impact percentages calculated are conservative: if more of the surrounding area had been walked it is highly likely (based on the number of CSF plants located in the non-impact areas), that more plants of each CSF would have been found, and this would result in a reduction of the impacts calculated.

4 Results – Survey

4.1 Survey Coverage Achieved over the Labouchere Survey Area

Thirty-eight relevé sites were assessed and 98.24 ha were surveyed via traverses walked over the LSA **(Map 9.10, Section 9)**. The information collected at each relevé is provided in **Table A4.1, Appendix 4** and their coordinates are listed separately in **Table A4.2, Appendix 4**. Coverage achieved over the LSA is detailed in **Table 4.1**. Coverage achieved along traverses is calculated using the length of traverses walked (65.49 km) multiplied by 15 m, which is the approximate width of the band of vegetation that the botanists were able to survey while walking traverses in the LSA.

Table 4.1: Survey coverage achieved

			Area (ha)			
Date	**Attribute**	**Number of relevés**	**Pit buffer**	**Labouchere HR***	**HR in Nathans***	**Non-impact**
Between October 2 and 4, 2016	Relevés	38				
	Traverses	-	18.69	13.55	3.64	62.36
Total area of each section (ha)			62.44	13.55	3.64	1,238.25
Coverage achieved (%)			29.93	100	100	5.04
Total area surveyed (ha)			98.24			
Total area of LSA (ha) – including HR in NSA			1,317.88			
Overall coverage achieved (%)			7.45			

Note: HR = Haul road corridor; * = the botanists walked a band of vegetation of approximately 15 m wide either side of the track and the areas included in Table 4.1 for the haul road corridor (Labouchere HR and HR in Nathans) do not include any amount for the existing track. One relevé was assessed in the HR corridor in the NSA during the NSA survey and it has not been included in the relevé count above.

4.2 General Flora

The following information was collected on the general flora of the LSA:

- 170 taxa were recorded from 80 genera and 34 families (73% perennial, 27% annual).
- The most common families were Fabaceae (35 taxa), Chenopodiaceae and Poaceae (both 15 taxa), Asteraceae (14 taxa) and Scrophulariaceae (13 taxa).
- The most common genera were *Acacia* (21 taxa), *Eremophila* (13) and *Senna* (9 taxa), *Sida* (7 taxa) and *Ptilotus* and *Calandrinia* (6 taxa).
- At the time of the survey 21% of the 170 taxa were flowering, 41% were fruiting and 26% were both flowering and fruiting i.e. 88% of the species listed had reproductive material on them at the time of the survey.
- The identities of four collections could not be confirmed beyond genus due to a lack of flowering or fruiting material - *Eriachne* sp. indet., *Indigofera* ?*gilesii* (potential P3), *Stenopetalum* sp. indet., and *Trianthema* sp. indet.. *Indigofera* ?*gilesii* was not included in the overall species counts as it is likely to be *Indigofera gilesii* (P3).

A list of the flora taxa recorded is included as **Table A6.1, Appendix 6**.

A comparison of the flora recorded in the LSA with that found in the surrounding areas is included in **Table 4.2**. Based on this information diversity in the LSA appears to be similar to that in the area surveyed by DPaW at Robinson Ranges and Mount Gould (Meissner *et al.*, 2009). Maia recorded 170 taxa from the 38 relevés assessed in the LSA while DPaW recorded 170 taxa from 50 quadrats. The LSA appears to be more diverse than the Fortnum 3 area surveyed by Maia (Maia, 2015); however, this most likely reflects the good winter rains received in the winter months before the survey in 2016 rather than it being a more diverse area. The effect of the rain can be seen in the percentage of annual species recorded in the LSA (approximately 27%) compared with in the area surveyed by Maia in 2014 (approximately 17%). More taxa were recorded in the NSA but this is likely a reflection of the smaller area of the LSA (approximately 1,318 ha) compared with the NSA (approximately 1,925 ha).

Table 4.2: Taxa recorded during this and other surveys

Survey location	Survey type	All taxa / natives / weeds	Survey timing (season)	No. of quadrats or relevés (km of traverses walked)	Area surveyed (ha)	Reference
LSA	Level 1	170 / 167 / 3	September / October 2016 (spring)	38 relevés (65)	98.24	This report
NSA	Level 1	212 / 205 / 7	September / October 2016 (spring)	24 relevés (64)	95.29	Maia (2016)
Fortnum 3	Level 1	208 / 206 / 2	August 2014 (winter)	183 relevés (234)	350.37	Maia (2015)
Horseshoe	Level 1	80 / 80 / 0	April 2013 (autumn)	10 relevés (none)	Not available	Umwelt (2013)
Robinson Range	Level 2	170 / 169 / 1	August 2006 (winter)	50 quadrats (none)	2.00	(Meissner, Owen and Bayliss, 2009)

4.3 Significant Flora

Significant flora are defined in EPA Guidance Statement No. 51 (EPA, 2004) as: taxa protected by the EPBC Act or the WC Act or classified by DPaW as priority species, species that play a keystone role, species of relic status, potential new discoveries, representative of the range of the species, a restricted subspecies, variety or naturally occurring hybrid, a species displaying local endemism or a poorly reserved species.

The following sections address significant flora of the LSA.

4.3.1 Threatened Flora

Flora species specially protected by the EPBC Act or the WC Act are listed as threatened species. Categories and definitions for threatened flora species are provided in **Tables A2.1 and A2.2 of Appendix 2.**

- No species protected by the EPBC Act were recorded in the LSA.
- No species protected by the WC Act were recorded in the LSA.

4.3.2 Priority Flora

Five confirmed priority (P) species were recorded in the LSA: *Stenanthemum mediale* (P1), *Eremophila obliquisepala* (P3), *Gunniopsis propinqua* (P3), *Indigofera gilesii* (P3) and *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362).

These species are described and shown in **Table 4.4** and their locations are shown on **Map 9.11, Section 9**. The locations have been supplied to Metals X electronically but have not been included as an appendix to this report because 1,331 CSF species waypoints were recorded during the survey.

The number of plants of each priority species and impacts estimated to each from the proposed works are presented in **Table 4.5**.

The number of *Eremophila obliquisepala* located in the LSA is very high. Cate Tauss identified this species from 16 plant specimens collected from the Nathans and Labouchere survey areas and all specimens had flowers and/or fruit.

All of the specimens identified as *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) had reproductive material on them. This species is very similar to *Thryptomene decussata* with the same sessile flowers, ribbed hypanthium and decussate leaf shape. The difference between them is that *T.* sp. Leinster has more densely packed leaves.

4.3.3 Regional Endemics

Regional endemics are plants that are geographically restricted to a particular locality or region. No regional endemic was listed in an LSA specific search using NatureMap (DPaW, 2007-); however, *Solanum reclusum* (P1) was listed in the results of a search carried out over a wider area (**Figure A1.2, Appendix** 1). No regional endemic species were located in the LSA.

4.3.4 Range Extensions

Species have a typical range which is indicated by their known distribution records. Sometimes species are recorded during a survey, which have not been located previously in the area; these species are described as range extensions. In some cases a range extension reflects a lack of surveys in a particular area or submissions of flora records to the WA Herbarium rather than a true range extension.

Using 100 km as the minimum distance from an existing record to define a range extension, 17 range extension species were collected from the LSA (**Table 4.3**). Three of these are listed as priority species – *Stenanthemum mediale* (P1), *Indigofera gilesii* and *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (both P3).

[Note, however, that Maia has collected specimens of five of the species listed in **Table 4.3** (*Hybanthus aurantiacus*, *Indigofera gilesii*, *Stenanthemum mediale*, *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) and *Trichodesma zeylanicum* var. *zeylanicum*) from neighbouring tenements.]

Table 4.3: Range extension species recorded in the Labouchere Survey Area

Species	Closest WAH (1998 -) record from LSA	Distance and direction from LSA
Acacia cockertoniana	Weld Range (Murchison bioregion)	202 km south-west
Acacia quadrimarginea	Meekatharra (Murchison bioregion)	145 km south
Calandrinia sp. Lumeah (R.W. Purdie 2168)	Jundee Airstrip (Murchison bioregion)	261 km south-east
Enneapogon lindleyanus	Paraburdoo (Pilbara bioregion)	233 km north

Species	Closest WAH (1998 -) record from LSA	Distance and direction from LSA
Hybanthus aurantiacus	Lofty Ranges (Gascoyne bioregion)	130 km north-east
Indigofera fractiflexa subsp. *fractiflexa*	Newman (Pilbara bioregion)	248 km north
***Indigofera gilesii* (P3)**	Glengarry Range (Murchison bioregion)	128 km south-east
Ixiochlamys cuneifolia	Mount Augustus (Gascoyne bioregion)	170 km north-west
Maireana polypterygia	Dairy Creek Station (Gascoyne bioregion)	240 km west
Myriocephalus appendiculatus	Lake Way Station (Murchison bioregion)	288 km south-east
Senecio hamersleyensis	Savory Creek (Gascoyne bioregion)	275 km north-east
Senna sp. Austin (A. Strid 20210)	Belele Station (Murchison bioregion)	123 km south
Sida brownii	Mount Vernon Station (Gascoyne bioregion)	120 km north
***Stenanthemum mediale* (P1)**	Jack Hills (Murchison bioregion)	130 km south-west
***Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3)**	Wiluna (Murchison bioregion)	213 km south-east
Tribulus hirsutus	Wiluna (Murchison bioregion)	203 km south-east
Trichodesma zeylanicum var. *zeylanicum*	Carnarvon Range (Gascoyne bioregion)	235 km east

Table 4.4: Conservation significant flora species located in the Labouchere Survey Area

Species description and habitat	Photographs	
***Stenanthemum mediale* (P1) - Rhamnaceae** *S. mediale* is an erect shrub growing to 0.4 m high (WAH, 1998-). The leaf margins are entire and the leaves have an apex (Rye, 2007). Flowers are produced from April to August and *S. mediale* grows on red-clayey sand (WAH, 1998-). *S. mediale* was found growing in a minor gully close to the top of a hill in the LSA, the plants were fruiting in October 2016 and one specimen was collected for confirmation by the taxonomist.	 **Growth habit (photograph from Maia library not taken at site)**	 **Close-up of leaves and flowers (photograph from Maia library not taken at site)**
***Eremophila obliquisepala* (P3) - Scrophulariaceae** *E. obliquisepala* is a low, spreading and compact shrub growing to between 0.2-0.5 m in height. Its leaves are short, broad and alternate and have serrated margins and recurved tips. The leaves range between 14-30 mm long and 4.5 to 10 mm wide (Brown and Buirchell, 2011). Its corolla is blue to purple and 20 to 30 mm long. *E. obliquisepala* flowers from May to August, its fruits are hairy and it is typically found growing on sand on open hardpan plains and ridges (WAH, 1998-). *E. obliquisepala* was found on the stony plains of the LSA, plants were flowering and fruiting in October 2016 and 16 specimens were collected for confirmation by the taxonomist.	 **Growth habit**	 **Close-up of leaves and flowers**

Species description and habitat	Photographs	
***Gunniopsis propinqua* (P3) - Aizoaceae** *G. propinqua* is a small prostrate annual or perennial herb growing from 0.03 m to 0.1 m high. Its flowers are white/pink and they are produced from August to September (WAH, 1998-). It is found on stony sandy loam, winter-wet sites and lateritic outcrops (WAH, 1998-). *G. propinqua* was found on the stony plains of the LSA and the plants were in bud and fruiting in October 2016; four specimens were collected for confirmation by the taxonomist.	 **Growth habit**	 **Close-up of leaves and flower buds**
***Indigofera gilesii* (P3) - Fabaceae** *I. gilesii* is an upright, open shrub growing to 1.5 m high. It has silvery and hairy young stems becoming pink with age. The leaves are bipinnate (leaflets subdivided into smaller leaflets) and grey-green in colour. It produces purple-pink flowers from May to August and its fruit are narrow cylindrical red-brown pods. It typically grows on pebbly loams with boulders and on outcrops on hills or along drainage channels and creeklines. *I. gilesii* was found growing in drainage lines of the LSA. Plants were fruiting in October 2016 and one specimen was collected for confirmation by the taxonomist.	 **Habitat (photograph from Maia library not taken at site)**	 **Close-up of flower and leaves (photograph from Maia library not taken at site)**

Species description and habitat	Photographs	
***Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3) – Myrtaceae** *T.* sp. Leinster is a shrub growing to 3 m in height. The small leaves have numerous glands and when crushed smell of 'tea-tree oil' and the small white flowers are produced from August to October. It is generally found on granite breakaways, low stony hills and sandstone outcrops (WAH, 1998-). *T.* sp. Leinster was found growing on hill slopes of the LSA and it was flowering and/or fruiting in October 2016 - four specimens were collected for identification by the taxonomist.		
	Growth habit (photograph from Maia library not taken at site)	**Close-up of leaves and old flowers (photograph from Maia library not taken at site)**

Table 4.5: Number of priority species found in impact and non-impact areas and impact estimated to each species

Species	Priority (P)	Number of plants					Plant #	Impact (%)
		A – Pit buffer	B - Labouchere HR	C – Labouchere HR in NSA	D – Impact areas total	E - Non-impact areas	F – LSA total	G - Impact
Stenanthemum mediale	P1	9	0	0	9	0	9	100.00
Eremophila obliquisepala	P3	0	116	0	116	3,190	3,306	3.51
Gunniopsis propinqua	P3	0	0	2	2	48	50	4.00
Indigofera gilesii/Indigofera ?gilesii	P3	2	1	0	3	0	3	100.00
Thryptomene sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	P3	0	0	0	0	10	10	0

Note: D - Impact areas total = number of plants in the haul road corridor (within LSA and Labouchere haul road in NSA) and in the pit buffer areas (columns A+B+C); E - Non-impact areas total = number of plants located in areas outside the pit buffer and sections of haul road corridor (i.e. in non-impact areas); F - LSA overall total = totals of columns A+B+C+E (includes the HR corridor outside of the LSA and in NSA); G – the impact estimated from the proposed works for each of the species located in the LSA; HR = haul road corridor.

This page is intentionally blank.

4.4 Introduced Flora

4.4.1 National Weeds Lists

- No weeds on any of the national weeds lists were recorded in the LSA.

4.4.2 Plant Pests Declared in Western Australia

- No plant species declared as a pest in WA was recorded in the LSA.

4.4.3 Environmental Weeds

Three general environmental weed species were located in the LSA, *Bidens bipinnata* (Bipinnate Beggartick), *Cenchrus ciliaris* (Buffel Grass) and *Rumex vesicarius* (Ruby Dock). The Midwest region impact and invasiveness ratings (DPaW, 2016e) for these three weed species are listed in **Table 4.6**; two have a high ecological impact and rapid invasiveness.

A map showing the distribution of these weeds in the LSA is included as **Map 9.12, Section 9**. The locations have been supplied to Metals X electronically but their coordinates are not included in this report.

Table 4.6: Weed species located in the Labouchere Survey Area and ecological impact and invasiveness ratings

Taxa	Number of plants	Ecological impact	Invasiveness
Bidens bipinnata (Bipinnate Beggartick)	530	Unknown	Rapid
Cenchrus ciliaris (Buffel Grass)	25	High	Rapid
Rumex vesicarius (Ruby Dock)	2,681	High	Rapid

Note: Columns 3 and 4 from DPaW (2016e).

4.5 Vegetation

4.5.1 Vegetation Types

Eight vegetation types are described (**Table 4.7**) and mapped over the LSA **Map 9.13, Section 9**. The legend for the mapped vegetation types is included as **Table 9.1, Section 9**.

Table 4.7 provides the following information on each vegetation type mapped in the LSA:

- the broad floristic formation;
- vegetation type detailed description;
- habitat;
- distribution;
- associated species;
- relevés assessed in vegetation type; and,
- average vegetation condition.

Information collected at each relevé is included in **Appendix 4**.

In order to correlate with the broad floristic formation descriptions, vegetation descriptions have been ordered using the dominant cover class as the indicator and not the dominant stratum e.g. Sparse Tall *Acacia* Shrubland of either *Acacia incurvaneura* or *A. aptaneura* with a Sparse mixed Low Shrubland (*Eremophila phyllopoda*, *Ptilotus schwartzii*, and *Scaevola spinescens*) and Isolated Low Trees of *Acacia pruinocarpa* and/or *A. citrinoviridis*.

The codes used for the vegetation types are based on the broad floristic formation e.g. *A***SL** for *Acacia* Shrubland, *A***WL** for *Acacia* Woodland and M**SL** for Mixed Shrubland, and are suffixed by a number to distinguish between multiples e.g. *Acacia* shrublands - *A***SL**-1, *A***SL**-2, *A***SL**-3.

Areas already cleared (for roads, tracks, pit and mine infrastructure) are mapped as Disturbed.

The regional and local significance of these vegetation types is discussed in **Section 5.2.3**.

Table 4.7: Vegetation types mapped in the Labouchere Survey Area

Code	Description		Photograph
*A***SL**-1	**Broad floristic formation**: *Acacia* Shrubland **Vegetation type**: Sparse Tall *Acacia* Shrubland of either *Acacia incurvaneura* or *A. aptaneura* with a Sparse mixed Low Shrubland (*Eremophila phyllopoda*, *Ptilotus schwartzii*, and *Scaevola spinescens*) and Isolated Low Trees of *Acacia pruinocarpa* and/or *A. citrinoviridis.*	**Associated species:** *Acacia tetragonophylla*, *Aristida contorta*, *Cheilanthes sieberi* subsp. *sieberi*, *Goodenia tenuiloba*, *Maireana georgei*, *M. polypterygia*, *Ptilotus obovatus*, *P. roei.* **Relevés:** R09, R21, R37, R45	
	Habitat: Stony flat and undulating quartz plains and quartz and ironstone slopes. **Distribution:** relatively widespread across the LSA in association with vegetation type *A***SL**-2.	**Vegetation condition:** 2 (pristine or nearly so). No disturbance was noted at relevés assessed in this vegetation type.	
Code	**Description**		**Photograph**
A**SL**-2	**Broad floristic formation**: *Acacia* Shrubland **Vegetation type**: Sparse Tall Shrubland of *Acacia incurvaneura* and/or *A. rhodophloia* with a mixed Sparse Low Shrubland (*Eremophila jucunda* subsp. *jucunda*, ***E. obliquisepala* (P3)**, *Ptilotus schwartzii*) and Isolated Low Trees of either *Grevillea berryana*, *Acacia citrinoviridis* or *A. pruinocarpa*.	**Associated species:** *Acacia cockertoniana*, *A. pteraneura*, *A. quadrimarginea*, *Aristida contorta*, *Eremophila exilifolia*, *E. latrobei* subsp. *latrobei*, *Eriachne pulchella* subsp. *dominii*, *Euphorbia tannensis* subsp. *eremophila*, *Goodenia tenuiloba*, *Ptilotus obovatus*, *Sida* sp. dark green fruits (S. van Leeuwen 2260), *Sida* sp. Golden calyces glabrous (H.N. Foote 32), *Solanum lasiophyllum.* **Relevés:** R03, R05, R13, R16, R17, R18, R22, R36, R39, SHR3	
	Habitat: Stony flat and undulating quartz and ironstone plains and ironstone hill slopes. **Distribution:** Widespread on the ironstone hills and outcropping of the LSA.	**Vegetation condition:** 2 (pristine or nearly so). Exploration and mining activities were noted at relevés assessed in this vegetation type.	

Code	Description		Photograph
*A*SL-3	**Broad floristic formation**: *Acacia* Shrubland **Vegetation type**: Open Tall Shrubland of *Acacia Incurvaneura* or *A. aptaneura* with a mixed Low Open Shrubland (*Eremophila latrobei* subsp. *latrobei*, *E. jucunda* subsp. *jucunda* and *Dodonaea pachyneura*) and +/- Scattered Mallee Trees of *Corymbia ferriticola*.	**Associated species:** *Acacia rhodophloia*, *Aristida contorta*, *Eremophila exilifolia*, *E. glutinosa*, *Eriachne mucronata*, *Grevillea berryana*, *Ptilotus obovatus*, *P. schwartzii*, *Sida* sp. Excedentifolia (J.L. Egan 1925). **Relevés:** R08, R14, R38, R40, R41, R43, R44	
	Habitat: Crests and upperslopes of ironstone hills. **Distribution:** Mainly on the ironstone hill slopes and crests around the existing Labouchere pit but also in the south-western section of the LSA.	**Vegetation condition:** 2 (pristine or nearly so). Exploration tracks and areas adjacent to the existing pit and exclusion bund were noted at relevés assessed in this vegetation type.	
Code	**Vegetation type, condition and relevés**		**Photograph**
*A*SL-4	**Broad floristic formation**: *Acacia* Shrubland **Vegetation type**: Sparse Tall Shrubland of *Acacia aptaneura* and/or *A. xiphophylla* with a Sparse Low Shrubland of *Senna artemisioides* subsp. *oligophylla* x *helmsii* and *Solanum lasiophyllum* and a Sparse Chenopod Shrubland of *Sclerolaena eriacantha*, *Maireana georgei* and *Maireana villosa*.	**Associated species:** *Acacia cuthbertsonii* subsp. *cuthbertsonii*, *A. incurvaneura*, *A. pruinocarpa*, *A. tetragonophylla*, *Maireana suaedifolia*, *Ptilotus nobilis*, *Rhyncharrhena linearis*, *Sclerolaena cuneata*, *S. eurotioides*, *S. lanicuspis*. **Relevés:** R06, R07, R15, RR01	
	Habitat: Quartz stony plains. **Distribution:** Located in small patches mainly in the south-east of the LSA but also one small patch in the north-western section of the LSA.	**Vegetation condition:** 2 (pristine or nearly so). No disturbance was noted at relevés assessed in this vegetation type.	

Code	Vegetation type, condition and relevés		Photograph
*A***SL**-5	**Broad floristic formation**: *Acacia* Shrubland **Vegetation type**: Open Tall Shrubland of *Acacia cuthbertsonii* subsp. *cuthbertsonii*, +/- *A. incurvaneura* or *A. rhodophloia* with a Sparse mixed Low Shrubland (*Dodonaea petiolaris*, *Eremophila glutinosa* and *E. exilifolia*) and Isolated Low Trees of *Acacia citrinoviridis* and/or *Grevillea berryana.*	**Associated species:** *Dodonaea pachyneura*, *Enneapogon lindleyanus*, *Eremophila latrobei* subsp. *latrobei*, *Eriachne mucronata*, *Goodenia tenuiloba*, *Grevillea deflexa*, *Harnieria kempeana* subsp. *muelleri*, *Hibiscus* sp. Gardneri (A.L. Payne PRP 1435), *H. sturtii* var. *forrestii*, *Psydrax latifolia*, *Ptilotus obovatus*, *Sida ectogama*, *S.* sp. Excedentifolia (J.L. Egan 1925). **Relevés:** R42, R46, R58	
	Habitat: Minor drainage lines and gullies. **Distribution:** Located in the minor drainage lines and gullies between ironstone hills over the whole of the LSA.	**Vegetation condition:** 2 (pristine or nearly so). No disturbance was noted at relevés assessed in this vegetation type.	
Code	**Description**		**Photograph**
*A***WL**-1	**Broad floristic formation**: *Acacia* Woodland **Vegetation type**: Low Woodland to Low Open Forest of *Acacia incurvaneura*, *A. aptaneura* and *A. cyperophylla* var. *cyperophylla* with a mixed Tall Shrubland (*Acacia cuthbertsonii* subsp. *cuthbertsonii*, *A. ramulosa* var. *linophylla*, *Eremophila forrestii* subsp. *forrestii*) and a mixed Low Shrubland (*Indigofera monophylla*, *Abutilon cryptopetalum* and *Enchylaena tomentosa* var. *tomentosa*).	**Associated species:** *Aristida contorta*, *Chrysopogon fallax*, *Dysphania rhadinostachya* subsp. *rhadinostachya*, *Eragrostis eriopoda*, *Eremophila glutinosa*, *Eriachne pulchella* subsp. *dominii*, *Evolvulus alsinoides* var. *villosicalyx*, *Goodenia tenuiloba*, *Hakea lorea* subsp. *lorea*, *Hibiscus* sp. Gardneri (A.L. Payne PRP 1435), *Phyllanthus erwinii*, *Senna artemisioides* subsp. *helmsii*, *Sida* sp. dark green fruits (S. van Leeuwen 2260), *S.* sp. verrucose glands (F.H. Mollemans 2423), *Trachymene pilbarensis.* **Relevés:** R01, R02, R04, R12, R19	
	Habitat: Low lying areas, depressions and broad drainage areas. **Distribution:** Located in low lying areas, depressions and broad drainage lines across the LSA.	**Vegetation condition:** 2 (pristine or nearly so). Minor grazing was noted at relevés assessed in this vegetation type.	

Code	Vegetation type, condition and relevés		Photograph
M**SL**-1	**Broad floristic formation**: Mixed Shrubland **Vegetation type**: Sparse mixed Shrubland (*Senna glaucifolia*, *Eremophila phyllopoda* and *Ptilotus rotundifolius*) and a Sparse to Open Tussock Grassland of *Aristida contorta*.	**Associated species:** *Acacia aptaneura*, *A. cuthbertsonii* subsp. *cuthbertsonii*, *A. incurvaneura*, *A. pteraneura*, *Calocephalus beardii*, ***Eremophila obliquisepala* (P3)**, *Goodenia tenuiloba*, *Maireana georgei*, *Psydrax latifolia*, *Ptilotus roei*, *Senna artemisioides* subsp. *helmsii*, *S. glutinosa* subsp. *pruinosa*, *Sida* sp. dark green fruits (S. van Leeuwen 2260), *Solanum lasiophyllum.* **Relevés:** R10, R11, R47, R48, R49	
	Habitat: Undulating quartz and ironstone stony plains. **Distribution:** Located in the central western section of the LSA.	**Vegetation condition:** 2 (pristine or nearly so). No disturbance was noted at relevés assessed in this vegetation type.	
M**SL**-2 (see note below table)	**Broad floristic formation**: Mixed Shrubland **Vegetation type**: Sparse mixed Low Shrubland (*Pluchea dentex*, *Grevillea deflexa* and *Calytrix desolata*) with Isolated Low Trees of *Acacia citrinoviridis.*	**Associated species:** *Acacia cuthbertsonii* subsp. *cuthbertsonii*, *A. pruinocarpa, A. rhodophloia, Aristida contorta, Dodonaea pachyneura, Duperreya commixta, Eremophila phyllopoda, Eriachne mucronata, Eriachne pulchella* subsp. *dominii, Mirbelia rhagodioides, Senna* sp. Austin (A. Strid 20210) (RE), *Sida ectogama.* **Relevé:** R32	
	Habitat: Minor drainage lines. **Distribution:** Located in the minor drainage lines over the whole of the NSA.	**Vegetation condition:** 2 (pristine or nearly so). Minor grazing, feral animal tracks and exploration tracks were noted in this vegetation type.	

Note: vegetation type M**SL**-2 occurs only along the section of Labouchere haul road in the Nathans Survey Area and this information is extracted from the report prepared on that survey area (Maia, 2016).

4.5.2 Vegetation Type Cover

The area of each of the vegetation types mapped in the LSA is listed in **Table 4.8**.

Table 4.8: Area and cover of vegetation types

Vegetation type code: broad floristic formation	Mapped in the LSA		Cover in non-impact areas (ha)	Cover in impact areas				
	Area (ha)	Cover (%)		Pit buffer (ha)	Labouchere HR (ha)	Labouchere HR inside NSA (ha)	Impact to vegetation type and disturbed areas from Labouchere project	
							ha	%
*A***SL**-1: *Acacia* Shrubland	305.18	23.16	293.65	8.21	3.32	0	11.53	3.78
*A***SL**-2: *Acacia* Shrubland[ŧ]	595.08	45.16	572.43	17.46	4.20	0.99	22.65	3.81
*A***SL**-3: *Acacia* Shrubland	94.82	7.19	87.69	7.13	0	0	7.13	7.52
*A***SL**-4: *Acacia* Shrubland	47.41	3.60	47.19	0	0.22	0	0.22	0.47
*A***SL**-5: *Acacia* Shrubland	35.50	2.69	29.70	5.72	0.09	0	5.81	16.36
*A***WL**-1: *Acacia* Woodland	55.36	4.20	55.23	0	0.12	0	0.12	0.22
M**SL**-1: Mixed Shrubland[ŧŧ]	77.37	5.87	76.83	0	0	0.55	0.55	0.71
M**SL**-2: Mixed Shrubland[ŧŧŧ]	0.03	0.00	0	0	0	0.03	0.03	100.00
Disturbed	107.11	8.13	75.53	23.92	5.59	2.08	31.59	29.49
Total	**1,317.88**	**100.00**	**1,238.25**	**62.44**	**13.55**	**3.64**	**79.63**	**6.04**
Current clearing in LSA (ha/%)	**107.11**	**8.13**						
Proposed clearing in LSA (undisturbed areas) (ha/%)							**48.04**	**3.65**
Cumulative clearing (current + proposed) in whole of LSA	**155.16 ha/11.77%**							

Note: LSA = Labouchere Survey Area, HR = haul road corridor, Labouchere HR inside NSA refers to the section of the haul road corridor to the south-east of and outside the eastern boundary of the LSA in the NSA; impacts (%) in column 9 are calculated using the area of each vegetation type or disturbed areas mapped in the LSA and not using the total area of the LSA; [ŧ] A**SL**-2 was also mapped in the NSA and the impact above is calculated using the area mapped in the LSA, it does not include the 637.08 ha mapped in the NSA (Maia, 2016); [ŧŧ] M**SL**-1 was also mapped in the NSA and the impact above is calculated using the area mapped in the LSA, it does not include the 29.87 ha mapped in the NSA (Maia, 2016); [ŧŧŧ] M**SL**-2 was also mapped in the NSA and the impact above is calculated using the area mapped in the LSA only, it does not include the 26.25 ha mapped in the NSA (Maia, 2016). 0 = zero, 0.00 = a value less than 0.00.

4.5.3 Vegetation Condition

Using the average vegetation condition assigned to the relevés surveyed in each vegetation type, weed information, notes recorded by botanists while traversing the LSA and any obvious disturbance seen on aerial photography while mapping the vegetation, the dominant vegetation condition in the LSA is rated as 2 (89.16%) (**Map 9.14, Section 9**). Additional information on vegetation condition in the LSA is included in **Table 4.9**.

Table 4.9: Vegetation condition

Vegetation condition	Area (ha) in the LSA	Cover (%)	Vegetation types	Comments
2 (pristine or nearly so)	1,175.02	89.16	*A***SL**-1, *A***SL**-2, *A***SL**-3, *A***SL**-4, *A***SL**-5, *A***WL**-1, M**SL**-1	Includes the majority of the LSA, which is uncleared and where there are very few weeds and minimal grazing and trampling by feral animals.
3 (slight to obvious signs of damage since European settlement)	35.73	2.71	*A***SL**-1, *A***SL**-2	The areas mapped as 3 are mostly adjacent to major clearing e.g. the existing pit and waste dump in the LSA and where there is now some native regrowth. The structure of the vegetation has been altered in these areas; however, with time, it is likely to return to the state of the surrounding vegetation.
7 (areas completely or almost completely without native species in vegetation structure)	107.11	8.13	Disturbed	Includes the areas previously cleared for infrastructure e.g. pit, waste dump, minor tracks and haul road. The vegetation structure has been significantly altered by clearing.

Note: See Table 3.1 for full description relating to numbers in column 1.

4.6 Ecological Communities

4.6.1 Threatened Ecological Communities

- No TECs are currently listed in the Gascoyne bioregion.

4.6.2 Priority Ecological Communities

- Three of the vegetation types recorded in the LSA are similar to three of the vegetation communities described by DPaW in the closest PEC to the LSA – the Robinson Range vegetation complexes Priority 1 PEC (this is discussed in **Section 5.3**).

4.7 Groundwater Dependent Ecosystems

Some of the species located along the larger drainage lines of the LSA, particularly the trees and larger shrubs, are likely to use groundwater at least some time during the year.

5 DISCUSSION

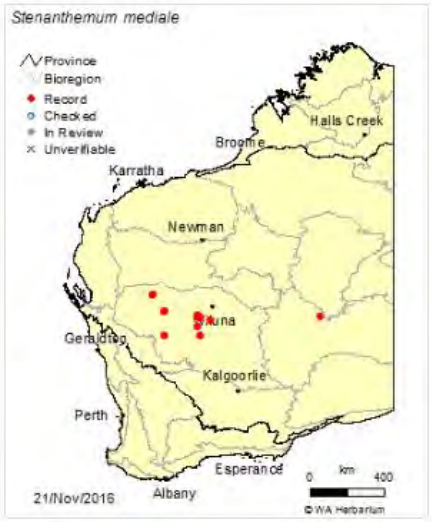
A brief discussion of the conservation significance of the flora and vegetation of the LSA follows. Significance is assessed at both regional and local scales (EPA, 2004).

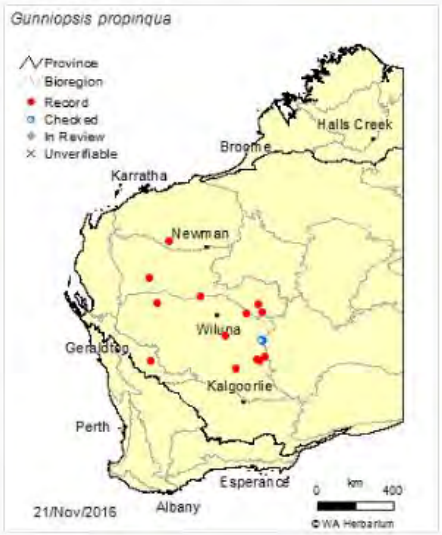
5.1 CONSERVATION SIGNIFICANCE - FLORA

5.1.1 Regional Significance

The regional conservation significance of each of the five priority flora species recorded in the LSA is indicated by its current priority rank. Their distribution in the region is described in **Table 5.1**, and an indication of the number of records currently occurring in protected areas is also included.

Table 5.1: Priority flora species

Current status	Current distribution
Stenanthemum mediale (P1) has 22 records on FloraBase and they are in the Murchison and Great Victoria Desert bioregions (WAH, 1998-). Frequency, when noted in the FloraBase records, is described as very sparse and isolated plants, and 20 plants are recorded for one record. One of the records falls on the boundary of ex Lake Mason Station and another on the boundary of ex Kaluwiri, both DPaW managed land (DPaW, 2007-).	
Eremophila obliquisepala (P3) has five records on FloraBase (WAH, 1998-) and they are in the Gascoyne and Murchison bioregions. The frequency, when noted in the FloraBase records, varies from infrequent to locally common. None of the five records falls within the boundaries of any reserves or any other DPaW managed lands (DPaW, 2007-).	

Current status	Current distribution
Gunniopsis propinqua (P3) has 17 records on FloraBase (WAH, 1998-) and they are in the Pilbara, Gascoyne, Murchison and Yalgoo bioregions. The frequency, when noted on FloraBase records, varies from isolated plants to abundant. One of the records lies within the boundaries of Mount Augustus National Park and one within the boundaries of Doolgunna Station, which is now managed by DPaW (DPaW, 2007-).	
Indigofera gilesii (P3) has 20 records on FloraBase (WAH, 1998-). The majority of the records are in the Pilbara bioregion while others are in the Central Ranges, Murchison and Tanami bioregions. The frequency of plants noted at each recorded location varies from common (50+ plants) to occasional to sparse (two plants). One of the records falls within the boundaries of Karijini National Park and another within the boundaries of Mooloogool Station which is now managed by DPaW (DPaW, 2007-).	
Thryptomene sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3) has 19 records on FloraBase all from the Murchison bioregion (WAH, 1998-). Frequency of plants, when noted, varies from uncommon (10-20 plants) to locally common and dominant and plant numbers, when noted, range from five to 300+. One of the records falls within the boundaries of ex Doolgunna Station (now managed by DPaW) and another falls just inside the north-western boundary of Wanjarri Nature Reserve (DPaW, 2007-).	

Note: P1 = Priority 1 and P3= Priority 3 flora species. Images used with the permission of the Western Australian Herbarium, Department of Parks and Wildlife (http://florabase.dpaw.wa.gov.au/help/copyright). Accessed on Monday 21 November 2016.

5.1.2 Local Significance

The local conservation significance of the five priority species recorded in the LSA is discussed below. Significance ratings (low, moderate or high) are based on: the number of locations at which plants were recorded in the Survey Area; the number or cover of plants at each location; the priority rank of the species; their distribution within the Survey Area (limited or widespread); and, the cover of the vegetation association in which they occur. The area surveyed in the LSA relative to the number of plants located has also been considered – as only approximately 5% of the LSA outside of the pit buffer and haul road corridors was surveyed, it is likely that more of the five CSF species located in the surveyed portion of the LSA will occur in these non-impact areas.

Stenanthemum mediale (P1) was recorded at two locations close to one another in the LSA. Five plants were recorded at one location and four at the other. It was found in a minor gully at the top of a hill and occurs in a small patch of vegetation type *A***SL**-5. These *S. mediale* are rated as having high local significance based on the number of locations and plants and the cover of the single vegetation type in which they were located in the LSA.

Eremophila obliquisepala (P3) was recorded at 376 locations (3,306 plants) in the LSA and it was recorded in numbers ranging from 1-100 plants. It was found on stony plains and in seven vegetation types – *A***SL**-1, *A***SL**-2, *A***SL**-3, *A***SL**-4, *A***SL**-5, *A***WL**-1 and M**SL**-1. Given the wide distribution of this species in the LSA, the numbers in which it was located, and the number and cover of the vegetation types in which it occurs, the *E. obliquisepala* of the LSA is rated as having low local significance.

Gunniopsis propinqua (P3) was recorded at seven locations (48 plants) in the LSA and it was recorded in numbers ranging from 1-30 plants. It was found on stony plains and in three vegetation types - *A***SL**-2, *A***SL**-4 and M**SL**-1. Given the wide distribution of this species in the LSA, the numbers in which it was located, and the number and cover of the vegetation types in which it occurs it is rated as having low local significance.

Indigofera gilesii (P3) and *I.* ?*gilesii* (?P3) was recorded at two locations in the LSA. One *I. gilesii* was located and two *I.* ?*gilesii*. The plants were located in drainage lines and on hill slopes in vegetation types *A***SL**-2 and *A***SL**-5. Given the moderate distribution of the plants in the LSA, the numbers in which they were located and the cover of the vegetation types in which they occur, this species is rated as having moderate local significance.

Thryptomene sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3) was recorded at five locations (10 plants in total) in the LSA. It was recorded in low numbers at each location (1-4 plants) and was found on hill crests and slopes in vegetation types *A***SL**-2 and *A***SL**-3. Given the distribution of this species in the LSA and the cover of the vegetation types in which it occurs, it is rated as having moderate to high local significance.

The regional and local conservation significance assessment is summarised in **Table 5.2**.

Table 5.2: Summary of regional and local significance – conservation significant flora species

Species	Regional significance – priority rank	Local significance
Stenanthemum mediale	1	High
Eremophila obliquisepala	3	Low
Gunniopsis propinqua	3	Low
Indigofera gilesii	3	Moderate
Thryptomene sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	3	Moderate to high

5.2 Conservation Significance - Vegetation

The regional and local significance of the vegetation of the LSA is discussed in the following sub-sections.

5.2.1 Regional Significance

Conservation significance (low, moderate or high) of the vegetation of the LSA at a regional level is based on the representation of habitats recorded in the LSA at a bioregion level i.e. the Gascoyne bioregion. Land systems and Beard's pre-European vegetation mapping have been used to assess the significance of vegetation and habitats of the LSA at this level.

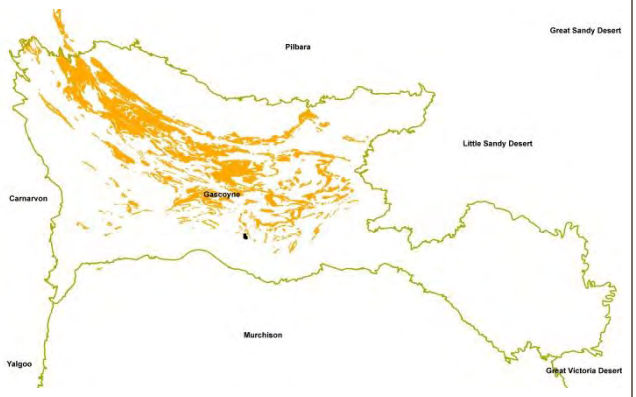
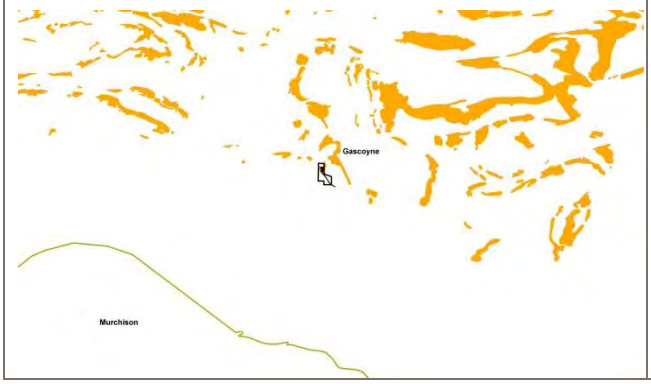
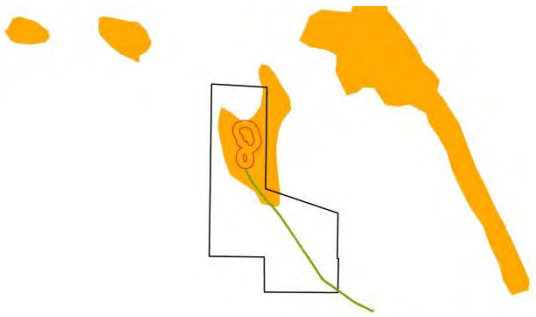
5.2.1.1 LAND SYSTEMS

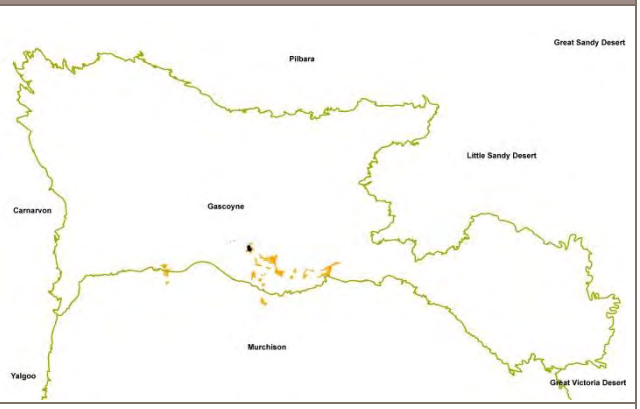
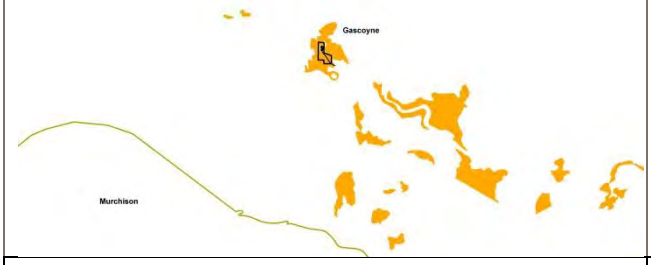
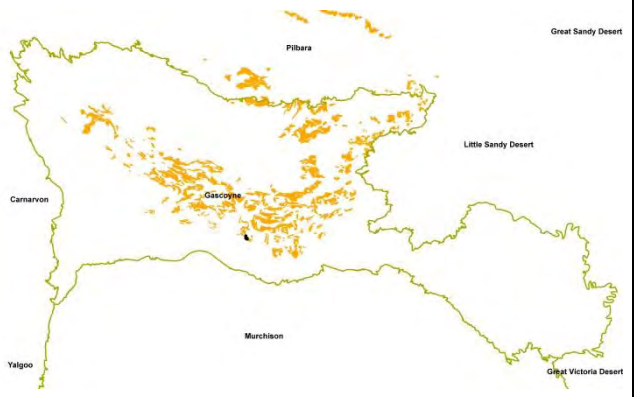
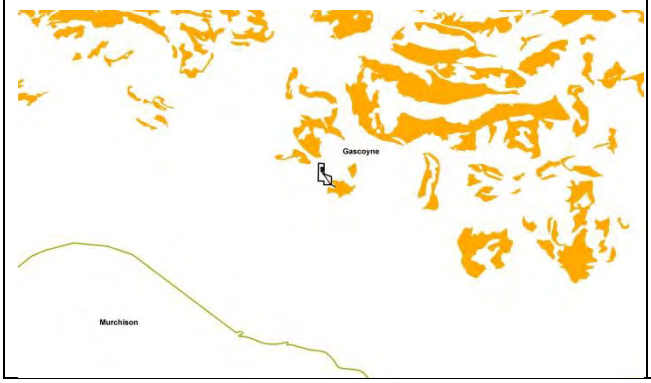
Three land systems are mapped in the LSA – Augustus, Beasley and Jamindie. The significance assessment for the land systems in the following paragraphs is based on the total extent of the land system, its distribution in the Gascoyne bioregion and the area occurring in DPaW managed lands.

The information in this section has been produced using shapefiles for land system (DAFWA, 2014), IBRA bioregion (DotEE, 2012) and DPaW Managed Lands (DPaW, 2016a) boundaries. Relevant shapefiles were intersected in ArcGIS.

The maps in **Table 5.3** show the LSA as a black polygon, the proposed pit area as a red eight-shaped polygon, the haul road as a bright green line and the bioregion boundaries as dull green. The extent of each land system in the Gascoyne bioregion and surrounds is shown as orange polygons.

Table 5.3: Extent, distribution and protection of the land systems in the Labouchere Survey Area

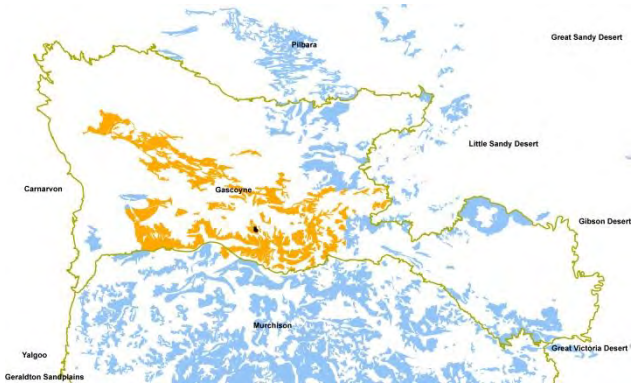
Current status	
The Augustus LS is mapped over 1,954,773 ha in WA and is a large land system. It is mapped in the Carnarvon, Gascoyne, Little Sandy Desert, Murchison and Pilbara bioregions (mostly in the Gascoyne, 1,906,888 ha) and occurs in six subregions, the largest areas in the Ashburton and Augustus subregions of the Gascoyne bioregion. Currently 484,969 ha of this land system lies in DPaW managed lands i.e. 24.8% of its mapped extent is protected. Based on this information, the area mapped in the LSA (281 ha) is rated as having low regional significance.	
	

Current status	
The Beasley LS is mapped over 78,754 ha in WA and is moderately sized. It is mapped in the Gascoyne and Murchison bioregions (mostly in the Gascoyne, 69,681 ha) and occurs in the Eastern and Western Murchison and Augustus subregions. Currently 18,129 ha of this land system lies in DPaW managed lands i.e. 23.0% of its mapped extent is protected. Based on this information, the regional significance of the area occurring in the LSA (1,037 ha) is rated as moderate.	
	
The Jamindie LS is mapped over 1,188,272 ha in WA and is relatively large. It is mapped in the Gascoyne, Little Sandy Desert and Pilbara bioregions (mostly in the Gascoyne, 994,587 ha) and occurs in the Ashburton, Augustus, Trainor, Chichester, Fortescue and Hamersley subregions. Currently, 135,999 ha of this land system lies in DPaW managed lands i.e. 11.4% of its mapped extent is protected. Based on this information, the regional significance of the area occurring in the LSA (1 ha) is rated as low.	
	

5.2.1.2 PRE-EUROPEAN VEGETATION MAPPING

One Beard vegetation system association (BVSA) is mapped in the LSA – **18.5**. The extent, distribution and protection of the Beard vegetation association (BVA) and BVSA in the Gascoyne bioregion is shown and discussed in **Table 5.4**. The maps in **Table 5.4** show the LSA in black (and the pit and haul roads red and bright green polygons respectively). The extent of BVSA 18.5 in the Gascoyne bioregion and surrounds is coloured orange and blue and orange polygons combined constitute the BVA while the bioregion boundaries are outlined in green. The maps in these tables were produced using IBRA bioregion boundaries (DotEE, 2012), pre-European vegetation shapefiles (DAFWA, 2012a) intersected with native vegetation extent (DAFWA, 2012b) shapefiles. Areas (ha) included in **Table 5.4** are from GoWA (2015).

Table 5.4: Extent, distribution and protection of BVSA 18.5 in the Labouchere Survey Area

Current status	
BVSA **18.5** is mapped in three bioregions (Gascoyne, Little Sandy Desert and Murchison) and five subregions – the three Gascoyne subregions (Ashburton, Carnegie and Augustus), one in the Little Sandy Desert (Trainor) and two in the Murchison (Eastern and Western Murchison). Currently, 99.92% (1,793,132.31 ha) of its Gascoyne pre-European extent still remains and 0.91% is protected for conservation. Because of its level of protection in IUCN I-IV and DPaW managed lands in the Gascoyne bioregion, its occurrence in three bioregions and five subregions and its wide spread in the Gascoyne bioregion, this BVSA in the LSA is rated as having low to moderate regional significance.	
	

5.2.2 Local Significance

The local significance of the land systems, pre-European vegetation association and vegetation types of the LSA is considered in the following section. Local significance is based on the cover of each in the LSA and surrounding local area.

5.2.2.1 LAND SYSTEMS

The LSA lies over sections of the Augustus (281 ha), Beasley (1,037 ha) and Jamindie (1 ha) land systems (**Table 5.5; Map 9.5, Section 9**).

The proportion of each of the land systems in the LSA – relative to its mapped extent in the Gascoyne bioregion – is less than 10%, and ranges from 0.01% of the Augustus to 1.49% of the Beasley LS (**Table 5.5**). Based on the percentages in columns 4 and 5 in **Table 5.5** the three land systems in the LSA are rated as having low local significance.

Table 5.5: Proportion of mapped and local extent of the land systems of the Labouchere Survey Area

Land system	Area in Gascoyne bioregion (ha)	Area in LSA (ha)	Proportion of Gascoyne extent in the LSA (%)	Proportion of the LSA (%)
Augustus	1,906,887.54	280.64	0.01	21.29
Beasley	69,680.73	1,036.58	1.49	78.66
Jamindie	994,586.56	0.65	0.00	0.05
Total area (ha) or %	2,971,154.83	1,317.88	-	100.00

Note: These areas include the section of haul road within the NSA; 0.00 = a number greater than zero but lower than 0.00.

5.2.2.2 PRE-EUROPEAN VEGETATION MAPPING

The LSA is mapped as BVSA 18.5 **(Table 5.6)**. The proportion of the BVSA's Gascoyne bioregion extent that lies in the LSA is 0.07%. If this percentage were to be calculated using the BVA rather than the BVSA it would be 0.04%. Given that the percentage is so low, BVSA 18.5 in the LSA is rated as having low local significance.

Table 5.6: Proportion of mapped and local extent of the vegetation system association of the Labouchere Survey Area

Vegetation system association	Current extent in the Gascoyne bioregion (ha) (GoWA, 2015)	Area (ha) in the LSA	Proportion of Gascoyne extent in the LSA (%)	Proportion of the LSA (%)
18.5	1,793,132.31	1,317.88	0.07	100.00

Notes: Government of Western Australia (2015) CAR assessment of IBRA subregions and vegetation associations used for current extent in Gascoyne bioregion. These areas include the section of haul road corridor inside the NSA.

Table 5.7 summarises the regional and local significance of the land systems and pre-European vegetation system association of the LSA.

Table 5.7: Summary of regional and local significance – land systems and vegetation system association

Vegetation	Regional significance	Local significance
Land system		
Augustus	Low	Low
Beasley	Moderate	Low
Jamindie	Low	Low
BVSA		
18.5	Low to moderate	Low

5.2.3 Vegetation Types Mapped by Maia

The area and proportion of the vegetation types mapped by Maia (MVT) in the LSA is summarised in **Table 5.8**.

The following attributes were considered during the assessment of local conservation significance of these vegetation types: the distribution and area of each vegetation type in the LSA (i.e. the local area), the significance or rarity of a habitat in which the type occurs, the CSF species occurring in each vegetation type, the condition of the vegetation in the type, any other key attributes (including the similarity of the type to any significant ecological communities known to occur in or close to the LSA) and the vegetation type's occurrence outside the boundaries of the LSA.

The occurrence and significance of the eight MVTs mapped in the LSA are discussed below.

MVT *A***SL**-1 is mapped over a moderate area (305.18 ha) on the stony, flat and undulating plains of the LSA. A similar community was not described by DPaW (Meissner *et al*., 2009); however, it is similar to Umwelt's S1 vegetation community which was mapped over 191.89 ha of the area surveyed (Umwelt, 2013). It is also similar to Maia vegetation association (MVA) *MpAc***TG** which was mapped over 2,292.02 ha on neighbouring tenements (Maia, 2015), but *A***SL**-1 doesn't have the tussock grass layer characteristic of *MpAc***TG**. Maia (2016) also mapped *A***SL**-1 over 829.78 ha of the adjacent NSA. *Eremophila obliquisepala* (P3) was recorded in this association.

MVT *A***SL**-2 is mapped over the largest area (595.08 ha) and is similar to DPaW's Community 6 (Meissner *et al*., 2009) and MVA *Ap***SL2,** which was mapped over 4,537.43 ha in neighbouring tenements (Maia, 2015) and to *A***SL**-2 mapped over 637.08 ha of the NSA (Maia, 2016). Umwelt did not describe or map a similar vegetation community (2012). *A***SL**-2 was recorded on the stony flat and undulating plains and the slopes of ironstone hills in the LSA. *Eremophila obliquisepala* (P3) was a dominant species in some areas of this MVT and *Gunniopsis propinqua*, *Indigofera gilesii* and *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (all P3) were also recorded in it.

MVT *A***SL**-3 was mapped over a moderate area (94.82 ha) and it is similar to DPaW's Community 5 and MVA *Ap***SL1**, which was mapped over 282.57 ha in the surrounding area (Maia, 2015) and to *A***SL**-3 mapped over 7.94 ha of the NSA (Maia, 2016). No similar community was mapped by Umwelt. *A***SL**-3 was recorded on the crest and upperslopes of ironstone hills in the LSA. *Eremophila obliquisepala* and *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (both P3) were recorded in it.

MVT *A***SL**-4 was mapped over a small area (47.41 ha) on quartz stony plains in the LSA. A similar community was not described by DPaW, Umwelt or by Maia in the NSA. However Maia mapped MVA *Aax***SL** over 161.77 ha in a neighbouring tenement, which was similar but was characterised by *Acacia* aff. *xiphopylla* (Maia, 2015). *Eremophila obliquisepala* and *Gunniopsis propinqua* (both P3) were recorded in *A***SL**-4.

MVT *A***SL**-5 was mapped over a small area of the LSA (35.50 ha) along minor drainage channels and gullies. DPaW did not describe a similar community but Umwelt community C2 and MVA M**WL1** are similar to *A***SL**-5 and were mapped over 50.54 ha and 1,041.97 ha respectively. This MVT was also mapped over 26.5 ha of the NSA as M**SL**-2. While M**SL**-2 lacks the tall shrub layer present in *A***SL**-5 it shares many of the associated species. *Eremophila obliquisepala* (P3), *Indigofera* ?*gilesii* (?P3) and *Stenanthemum mediale* (P1) were recorded in this MVT.

MVT *A***WL**-1 was mapped over 55.36 ha and is similar to DPaW's Community 3, Umwelt's community M1 (mapped over 8.83 ha) and MVA *Ap***WL (**mapped over 2,508.08 ha). Maia (2016) also mapped *A***WL**-1 over 52.20 ha of the NSA. *A***WL**-1 was recorded in low lying areas, depressions and broad drainage areas of the LSA and *Eremophila obliquisepala* (P3) was recorded in it.

MVT M**SL**-1 was mapped over 77.37 ha on undulating quartz stony plains of the LSA and a similar association was not described by DPaW or Maia (2015). Umwelt's community S5 is similar to M**SL**-1 and it was mapped over

323.93 ha. M**SL**-1 was also mapped over 29.87 ha of the undulating quartz stony plains of the NSA (Maia, 2016). *Eremophila obliquisepala* and *Gunniopsis propinqua* (both P3) were recorded in M**SL**-1 in the LSA.

M**SL**-2 was mapped over a small area of the NSA (26.25 ha, of which 0.03 ha is in the LSA) along minor drainage channels (Maia, 2016). DPaW did not describe a similar community but Umwelt community C2 and MVA M**WL1** are similar to M**SL**-2 and were mapped over 50.54 ha and 1,041.97 ha respectively. *Eremophila obliquisepala* (P3) was recorded in this MVT. MVT *A***SL**-5 was mapped over 35.50 ha of the LSA (along minor drainage channels and gullies) and it is very similar to M**SL**-2 - while M**SL**-2 lacks the tall shrub layer present in *A***SL**-5 it shares many of the associated species. *Eremophila obliquisepala* (P3) was mapped in M**SL**-2 in the NSA and *Eremophila obliquisepala* (P3)*, Indigofera* ?*gilesii* (?P3) and *Stenanthemum mediale* (P1) in *A***SL**-5 in the LSA.

The eight vegetation types of the LSA are therefore similar to vegetation mapped in the surrounding areas. As the land systems and BVA mapped in the LSA do not occur only in the LSA the vegetation types will occur in the wider area. MVTs *A***SL**-2 and *A***SL**-3 are similar to DPaW communities 6 and 5 respectively and these communities were the most common communities found across Robinson Range (Meissner *et al*., 2009). DPaW community 3 and communities 5 and 6 have been previously described in the Peak Hill land system in the Murchison River catchment (Meissner *et al*., 2009) and this land system also occurs in the wider area.

Based on the information above, the local conservation significance of five of the MVTs is rated as moderate and three as low (**Table 5.8**).

Table 5.8: Extent, significant flora, condition and local significance of vegetation types mapped in the Labouchere Survey Area

MVT	Area in LSA (ha)	CSF in MVT in LSA	Average vegetation condition	Any other key attributes increasing conservation value?	Occurs outside the LSA?	Local conservation significance
*A*SL-1	305.18	Eo	2	No	Yes	Low
*A*SL-2	595.08	Eo, Gp, Ig, TsL	2	No	Yes	Moderate
*A*SL-3	94.82	Eo, TsL	2	No	Yes	Moderate
*A*SL-4	47.41	Eo, Gp	2	No	Yes	Moderate
*A*SL-5	35.50	Eo, I?g, Sm		Drainage lines	Yes	Moderate
*A*WL-1	55.36	Eo	2	Drainage lines	Yes	Low
MSL-1	77.37	Eo, Gp	2	No	Yes	Moderate
MSL-2	0.03		2	Drainage lines	Yes	Low
Disturbed	107.11	Eo	7	-		
Area mapped in the LSA	1,317.88					

Notes: MVT = Maia vegetation type; Eo = *Eremophila obliquisepala* (P3), Gp = *Gunniopsis propinqua* (P3), I?g = *Indigofera* ?*gilesii* (?P3), Ig = *Indigofera gilesii* (P3), Sm = *Stenanthemum mediale* (P1), TsL = *Thryptomene* sp. Leinster (P3). The area included for ASL-2, M**SL**-1 and M**SL**-2 is for that in the LSA and does not include the area mapped over the whole of the NSA. Similarly the CSF are those located in the MVT in the LSA and they do not include any CSF located in the MVT mapped in the NSA.

5.3 Ecological Communities and Ecosystems at Risk

- The LSA does not lie within or close to a currently listed TEC and no TEC occurs within approximately 250 km of the LSA.

- The LSA does not lie within the boundaries of an area indicated as a PEC. One of the areas mapped as the Robinson Range vegetation complexes (banded iron formation) Priority 1 PEC is approximately 1 km south of the eastern end of the Labouchere haul road corridor in the NSA at its closest. The vegetation types of the LSA were compared (not statistically) with the descriptions for DPaW's Robinson Ranges vegetation communities and, based on landscape position and species, three of the vegetation types (*A***SL**-2, *A***SL**-3 and *A***WL**-1) are similar to three of the communities described by DPaW (communities 6, 5 and 3 respectively). Meissner *et al*. (2009) noted that communities 5 and 6 were among the most common found across Robinson Range and that the three communities were generally consistent with the *Acacia aneura*, *A. tetragonophylla* shrubland over *Eremophila*, *Cassia* and *Solanum* of the Peak Hill land system described by DAFWA. These three communities are therefore not restricted to the Robinson Range area or to the LSA.

- No ecosystem listed as at risk occurs in the LSA (Desmond, Kendrick and Chant, 2001).

5.4 Groundwater Dependent Ecosystems

Some of the trees and larger shrubs located along the larger drainage lines and creeks in the LSA are likely to use groundwater at least some time during the year. The closest of the larger creeks are between approximately 1.0 km and 2.0 km away from the centre of the existing Labouchere pit.

5.5 Clearing Principles

Under the *Environmental Protection Act 1986* (EP Act), clearing of native vegetation requires a permit unless its purpose is exempt. Any vegetation clearing requiring a Native Vegetation Clearing Permit (NVCP) needs to address 10 clearing principles as part of the permitting process.

The 10 clearing principles are addressed with respect to the LSA in **Table 5.9**.

Table 5.9: Clearing principles and the Labouchere Survey Area

Clearing principle	Labouchere Survey Area
a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	**Not at variance to this principle** The LSA does not lie in an area known for its high species diversity (DPaW, 2007-). Diversity in the LSA is low to moderate with an average of 15 species per 20 m by 20 m relevé. The number of taxa recorded in the LSA (170 taxa from 38 relevés and approximately 65 km of traverses) is a little higher than that recorded during surveys carried out in the surrounding areas. For example, DPaW located 170 taxa from 50 quadrats during its Robinson Range survey and Maia (2015) located 208 taxa from 183 relevés and 234 km of traverses in a neighbouring area. The fact that more taxa were located from fewer sites in the LSA than sampled at Robinson Range is probably a result of the traverses walked in the LSA and not over the Robinson Range, while the difference between taxa recorded in the two Maia surveys most likely reflects rainfall received in the months before the surveys. Good rains fell over winter 2016 and the total rainfall in the three months before the survey was above average. In winter 2014 rainfall in the three months before the survey was below average. This is reflected in the proportion of annual species in the species list for the LSA (27%) compared with that for the area surveyed by Maia in 2014 (17%).
b) Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	**Not assessed** Fauna habitat was not assessed by Maia.
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	**Not at variance to this principle** No Threatened/ DRF species were located in the LSA and, to date none have been located within approximately 30 km of the LSA. Four confirmed and one potential priority species were located in the potential impact areas – *Stenanthemum mediale* (P1), *Eremophila obliquisepala* (P3), *Gunniopsis propinqua* (P3) and *Indigofera gilesii* (P3) and *Indigofera* ?*gilesii* (?P3). Nine *Stenanthemum mediale* (P1) plants were recorded in the impact areas (pit buffer) and none in non-impact areas i.e. 100% of the *S. mediale* located in the LSA could be impacted by the project if the whole of the buffer around the pit was cleared. *S. mediale* has 22 FloraBase records in two bioregions. One hundred and sixteen *Eremophila oblequisepala* (P3) plants were recorded in the impact areas and a further 3,190 in non-impact areas i.e. a maximum of 3.5% of the *E. obliquisepala* located in the LSA could be impacted by the project if the whole of the Labouchere haul road corridor was cleared. *E. obliquisepala* has five FloraBase records in two bioregions. Two *Gunniopsis propinqua* (P3) plants were recorded in the impact areas and a further 48 in non-impact areas i.e. a maximum of 4.0% of the *G. propinqua* located in the LSA could be impacted by the project. *G. propinqua* has 17 FloraBase records in four bioregions.

Clearing principle	Labouchere Survey Area
	Three *Indigofera gilesii/I. ?gilesii* (P3/?P3) plants were recorded in the impact areas and none in non-impact areas i.e. 100% of the *Indigofera gilesii/I. ?gilesii* located in the LSA could be impacted by the project. *I. gilesii* has 20 FloraBase records in four bioregions. None of the habitats of the LSA is restricted to the LSA. The FloraBase locations for each of these species are all distant from the LSA and each species has been located during surveys carried out in the neighbouring area. Therefore these priority species do not rely on the vegetation and habitats of the LSA for their continued existence.
d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a TEC.	**Not at variance to this principle** The native vegetation in the NSA does not comprise the whole or a part of a TEC (or a PEC).
e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	**Not at variance to this principle** Native vegetation in the Gascoyne bioregion has not been extensively cleared and more than 99% of the BVA 18 in the LSA currently remains (GoWA, 2015). Currently, 8.1% (107.1 ha) of the LSA is mapped as disturbed and 91.9% (1,210.8 ha) as native vegetation. Up to 48.0 ha of undisturbed vegetation could be cleared for the project and 31.6 ha of already disturbed land. With the additional 48.0 ha of proposed vegetation clearing, disturbed areas would increase to a maximum of 11.8%. The areas to be cleared are not significant remnants of vegetation in an area that has been extensively cleared.
f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	**Potentially at variance to this principle** A number of different sized ephemeral creeks and drainage lines occur in the LSA. They are mapped as *A***SL**-5, *A***WL**-1 and M**SL**-2. A maximum of approximately 6.0 ha of these three vegetation types could be directly impacted by the project. There are no wetlands in the LSA.
g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	**Not at variance to this principle** Currently 8.1% of the LSA is disturbed/cleared. A maximum of an additional 48.0 ha of intact vegetation, i.e. a further 3.7% of the 1,317.9 ha LSA, could be cleared for the project and these areas are adjacent to those already cleared. This would bring the total cumulative clearing in the LSA to 11.8% if all of it was to be cleared. Given the relatively small area of additional/new clearing that could take place it is unlikely to cause appreciable land degradation.
h) Native vegetation should not be cleared if the clearing of vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	**Not at variance to this principle** The LSA does not lie within or adjacent to a conservation area. The nearest conservation area is Collier Range National Park approximately 69 km to the north-east of the LSA.

Clearing principle	Labouchere Survey Area
i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	**Not at variance to this principle** While relatively small areas will be cleared for the project, there might be some short-term deterioration in the quality of surface water around areas that have been cleared as runoff from the first good rains post clearing will tend to transport loose soil in the direction of flow. Once disturbed areas have settled and the soils have become more compacted this should stop. The small area of vegetation clearing proposed (48.0 ha in an area of 1,317.9 ha) is unlikely to cause the quality of underground water to deteriorate.
j) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	**Not at variance to this principle** A maximum of 48.0 ha of intact native vegetation could be cleared for the project. The pit buffer surrounds the existing Labouchere pit and 23.9 ha (38.3%) of the 62.4 ha buffer it is already disturbed. Similarly some of the vegetation along the 17.2 ha haul road corridor is already disturbed (7.7 ha, 44.6%). It is unlikely that additional vegetation clearing in these areas will exacerbate the incidence or intensity of flooding.

6 Summary of Results and Discussion and Recommendations

6.1 Flora

- One hundred and seventy taxa from 80 genera and 34 families were recorded in the LSA (73% perennial and 27% annual) and the flora of the LSA is similar to that recorded in the surrounding areas.
- No threatened species were located in the LSA.
- Five confirmed priority flora species were located in the LSA – *Stenanthemum mediale* (P1), *Eremophila obliquisepala*, *Gunniopsis propinqua*, *Indigofera gilesii* and *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (all P3). One potential priority flora species was located in the LSA - *Indigofera* ?*gilesii* (?P3).
- Three weed species were located in the LSA and none of them is on any of the national weed lists or listed as a declared pest in WA. Two of the species are listed as having high ecological impact and rapid invasiveness by DPaW (*Cenchrus ciliaris* and *Rumex vesicarius*).

6.2 Vegetation

- Eight vegetation types were mapped in the different habitats of the LSA. They are five different *Acacia* shrublands (mapped on: stony flat and undulating quartz plains and quartz and ironstone slopes, stony flat and undulating quartz and ironstone plains and ironstone hill slopes, crests and upperslopes of ironstone hills, quartz stony plains, in minor drainage lines and gullies), one *Acacia* woodland (mapped in low lying areas, depressions and broad drainage areas) and two different mixed species shrublands (mapped on: undulating quartz and ironstone stony plains and minor drainage lines).
- The condition of the vegetation over most of the LSA (89.2%) was rated as a 2 (pristine or nearly so), 8.1% was rated as a 7 (areas completely or almost completely without native species in vegetation structure) and 2.7% as a 3 (slight to obvious signs of human activities on the vegetation structure).

6.3 Regional and Local Significance of the Flora and Vegetation and Impacts

- One of the five confirmed/potential priority species located in the LSA is a P1 and four are P3/potential P3 species. One of the five species is rated as having high local significance (*Stenanthemum mediale*), one as moderate to high (*Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362)), one as moderate (*Indigofera gilesii*/*Indigofera ?gilesii*) and two as low (*Eremophila obliquisepala* and *Gunniopsis propinqua*). *T.* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) will not be directly impacted by any vegetation clearing within the pit buffer and haul road corridor (i.e. zero local impact). The local impact estimated for two species, *S. mediale* and *Indigofera gilesii*/*Indigofera ?gilesii*, is 100% while the local impact to *E. obliquisepala* and *Gunniopsis propinqua* is less than 5%. Given the relatively small area surveyed in the non-impact areas (approximately 5%) it is also likely that more plants of each of these species occur in the LSA and that the local impacts will be lower than those calculated.
- The regional significance of each of the land systems of the NSA is rated as low (Augustus and Jamindie) or moderate (Beasley) and the local significance of all three as low.
- The regional significance of BVSA 18.5 in the LSA is rated as low to moderate and the local significance as low.
- The eight vegetation types mapped in the LSA appear to be locally common, they occur in the surrounding areas and are rated as having either moderate (*A***SL**-2, *A***SL**-3, *A***SL**-4, *A***SL**-5 and M**SL**-1) or low (*A***SL**-1, *A***WL**-1 and M**S**L-2) local significance. Highest impact estimated for the vegetation types mapped in the LSA is 100% to M**S**L-2. However, this impact is calculated using the area of M**S**L-2 that occurs in the LSA only and not using the area that was mapped in the NSA; when the 26.25 ha mapped in the NSA is used to calculate impact it is less than 1%. Impact to *A***SL**-5 will be approximately 16%, to *A***SL**-3 approximately 8%, to *A***SL**-1

and *A***SL**-2 approximately 4% and impact to the remaining vegetation types will be less than 1% (*A***SL**-4, *A***WL**-1 and M**S**L-1).

6.4 Ecological Communities and Other Significant Areas

- No TEC occurs in or in the vicinity of the LSA.
- The LSA does not lie in a currently listed PEC.
- One of the areas mapped as the Robinson Range vegetation complexes (banded iron formation) Priority 1 PEC is approximately 1 km south of the eastern end of the Labouchere haul road at its closest. Three of the vegetation types (*A***SL**-2, *A***SL**-3 and *A***WL**-1) are similar to three of the communities described by DPaW on the Robinson Ranges (communities 6, 5 and 3 respectively). Meissner *et al*. (2009) noted that communities 5 and 6 were among the most common found across Robinson Range and all three were generally consistent with the *Acacia aneura*, *A. tetragonophylla* shrubland over *Eremophila*, *Cassia* and *Solanum* of the Peak Hill land system described by DAFWA. These three communities are therefore not restricted to the Robinson Range area.
- The LSA does not lie in former leasehold land, in an EPA Red Book area, in conservation estate, in a Schedule 1 area or in an ESA.

6.5 Groundwater Dependent Ecosystems

- Some of the trees and larger shrubs located along the larger creeks in the LSA are likely to use groundwater at least some time during the year. The closest of the larger creeks are between approximately 1.0 km and 2.0 km away from the centre of the existing pit.

6.6 Recommendations

- Direct impact to the priority species located in the LSA should be avoided or minimised whenever possible; particularly to the P1 species *Stenanthemum mediale*.
- As *Stenanthemum mediale* is a P1 species and it was located only in areas that could be cleared for the proposed works a follow-up targeted survey might be required to find more plants within the LSA but away from the impact areas to more accurately define local impacts to this P1 species. However, it has been located on a neighbouring tenement (E52/1671; seven plants).
- Direct impact to the vegetation of the LSA should be minimised as much as possible and clearing boundaries clearly marked to achieve this aim.
- Every effort should be made to prevent a) the introduction of new weeds into the area on machinery used for the earth works, and b) the spread of existing weeds into the surrounding area when soil and rock is moved from place to place.

7 Survey Limitations and Project Team

7.1 Survey Limitations

Guidance Statement 51 (EPA, 2004) states that reports produced on flora and vegetation surveys for environmental impact assessment in WA should contain a section describing the limitations of the survey methods used, and a suggested list of constraints (limitations) that these may cover is provided. **Table 7.1** lists each of these constraints and includes a comment on each with respect to this survey.

Table 7.1: Survey limitations

Limitation	Comment
Sources of information and availability of contextual information (i.e. pre-existing background versus new material)	**No limitation** A desktop study was carried out and the results of the database and literature searches are provided in **Section 2**. The EPBC Act Protected Matters search tool and NatureMap were used to gather information. Relevant environmental GIS layers were sourced and the results are included in **Section 2**. Beard's pre-European vegetation mapping, land systems, native vegetation extent and GoWA's vegetation statistics were used and information was available on flora and vegetation surveys conducted in the vicinity of the LSA e.g. Dames and Moore (1988), Meissner *et al*. (2009), Umwelt (2012 & 2013) and Maia (2015 & 2016).
The scope (i.e. what life forms, etc., were sampled)	**No limitation** Vascular flora species were sampled in the LSA.
Proportion of flora collected and identified (based on sampling, timing and intensity)	**No limitation** Thirty-eight relevés were assessed and 65.49 linear km of traverses were walked within the LSA in late September/early October 2016 (spring). The botanists assessed 98.24 ha/7.45% of the LSA. One hundred and seventy (170) taxa from 34 families and 80 genera were recorded in the LSA. Of these, 27% were annuals and 73% perennials. Three taxa could not be identified beyond genus because they had no flowering or fruiting material on them. A total of 88% of the species were flowering, fruiting or both. Three hundred and eighty-one (381) specimens were collected by the botanists from the Nathans and Labouchere survey areas. A specimen of most species encountered during the survey was collected. Common species known to the botanists were not collected. A NatureMap species list generated for the LSA and surrounds listed 107 species for a 30 km diameter circle encompassing the LSA (DPaW, 2007-). Given the relatively small area surveyed the species list from the survey of the LSA was good. Maia (2016) recorded 212 taxa in the Nathans Survey Area adjacent to the LSA. Maia (2015) recorded 208 taxa in neighbouring tenements, while DPaW recorded 170 taxa during its Robinson Ranges and Mount Gould survey (Meissner *et al*., 2009), Umwelt (2012) 101 taxa during its Fortnum mine area survey and 80 taxa during its Horseshoe survey Umwelt (2013) and Dames and Moore (1988) 59 taxa. The proportion of the flora collected and identified based on sampling, time and intensity was therefore good, especially as 27% of the taxa located were annual species reflecting the good rains received in the area over winter.

Limitation	Comment
Completeness and further work which might be needed (e.g. was the relevant area fully surveyed?)	**Possible limitation**
	A combined Level 1 flora and vegetation reconnaissance survey and targeted flora survey was conducted over the LSA and 7.45% of the LSA was surveyed overall. Approximately 30% of the pit buffer was surveyed, 100% of the haul road sections both inside and outside of the LSA and 5% of all other (non-impact) areas within the LSA. All sections of the LSA were relatively easily accessible via existing tracks and then walking to areas away from tracks. Good survey coverage was achieved, particularly in the areas to be impacted, and plants of known and suspected conservation significant species that were located were counted and their locations recorded on a GPS. Survey effort was concentrated in the areas where most impact is proposed but some of the remainder of the LSA was surveyed in order to provide context to impacts to the flora and vegetation from the proposed works. As one of the CSF located in the LSA is a P1 species (*Stenanthemum mediale*) and it was only located in areas that could be cleared for the proposed works, a follow-up targeted survey might be needed to find more plants within the LSA but away from the impact areas to more accurately define local impacts to this P1 species.
Mapping reliability	**No limitation**
	The vegetation was mapped at a scale of 1:30,000 using an aerial photograph captured in December 2014 and sourced from Bing Maps Aerial (Microsoft Corporation, 2016). Information on vegetation type boundaries and habitat changes were noted by the botanists while carrying out the survey and especially while walking traverses over the LSA. Bing aerial imagery is in World Geodetic System 1984 (WGS84) and all data collected and digitised by Maia is in GDA94, and therefore the boundaries could be out by 1-2 m. The mapping reliability is considered to be adequate for a Level 1 survey (EPA, 2004).
Timing, weather, season, cycle	**No limitation**
	The survey was conducted during late September/early October 2016 i.e. in the middle of spring. Rainfall in the general area over the three months before the survey in an area mapped as very much above average on BoM's rainfall deciles map for 1 July to 30 September 2016. Therefore the flora and vegetation should have been in good condition in spring 2016. Approximately 27% of the species recorded were annual and approximately 88% of the flora taxa recorded was flowering, fruiting or both flowering and fruiting. Based on this data the timing of the survey was appropriate.
Disturbances (fire, flood, accidental human intervention etc.)	**No limitation**
	No disturbances were evident or noted by the botanists while carrying out the survey. No floods, severe storms or fires had occurred in the weeks or months before the survey was carried out.
Intensity (in retrospect, was the intensity adequate?)	**No limitation**
	Thirty-eight relevés were assessed in the LSA and 7.45% of the LSA was sampled by two botanists for a total of five botanist survey days (i.e. two botanists for 2.5 days). The coverage achieved over the LSA as a whole is considered to be very good for this level of survey and the intensity of survey carried out in the areas that would be impacted most by the proposed mining activities was very good.
Resources	**No limitation**
	Adequate resources were employed during the survey – five botanist survey days were spent at the LSA by two botanists with eight to 10 years of experience of the flora and vegetation of WA and particularly of the Robinson Ranges area.

Limitation	Comment
Access problems	**No limitation**
	There were no access problems, as the LSA was accessible using existing tracks and by walking from these tracks to the boundaries.
Experience levels (e.g. degree of expertise in plant identification to taxon level)	**No limitation**
	Scott Hitchcock and Rochelle Haycock have conducted numerous surveys throughout WA over the past eight to 10 years and have carried out surveys over the Robinson Ranges and in the Peak Hill area. In addition to this, specimens for most of the species recorded during the survey were collected for formal identification using the resources of the WA Herbarium in Perth. The specimens were identified by Cate Tauss, a taxonomist with more than 25 years of experience in the taxonomy of the flora of the WA. Cate also liaised with experts at the WA Herbarium as necessary.

7.2 Project Team

The survey and reporting tasks carried out for this project were undertaken by the personnel listed in **Table 7.2**.

Table 7.2: Project team

Project team			
Name	**Qualification**	**Project role**	**Flora / DRF licence numbers**
Christina Cox	PhD	Report	Not applicable
Scott Hitchcock	BSc	Senior botanist - field team leader, field survey, report	SL011785/127-1516
Rochelle Haycock	BSc	Senior botanist - field survey & report	SL011786/ 07-1617
Cate Tauss	BSc Hons	Plant taxonomist	Not applicable

8 REFERENCES

Austlii (2016). Commonwealth Consolidated Regulations. Environment Protection and Biodiversity Conservation Regulations 2000 – Reg 7.02. Criteria for listing threatened ecological communities. Available: http://www5.austlii.edu.au/au/legis/cth/consol_reg/epabcr2000697/s7.02.html. Accessed: December 2016.

Australian Government (2016). National weeds lists. Available: http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/. Accessed: November 2016.

Brown, A and Buirchell, B (2011). A field Guide to the Eremophilas of Western Australia. Simon Nevill Publications, Perth, Western Australia.

Bureau of Meteorology (BoM) (2016a). GDE Atlas Home. Available: http://www.bom.gov.au/water/groundwater/gde/. Accessed: October and November 2016.

Bureau of Meteorology (BoM) (2016b). Climate Data Online. Available: http://www.bom.gov.au/climate/data/?ref=ftr. Accessed: September and October 2016.

Bureau of Meteorology (BoM) (2016c). Rainfall Deciles. Available: http://www.bom.gov.au/jsp/awap/rain/index.jsp?colour=colour&time=latest&step=0&map=decile&period=3month&area=wa. Accessed: October 6 2016.

Dames & Moore (1988). Flora and Fauna Survey, Fortnum Project. October 1988. Unpublished report for Homestake Australia Limited.

Department of Agriculture and Food Western Australia (DAFWA) (2012a). Pre-European Vegetation – Western Australia (NVIS compliant version - 20110715) [shapefile]. Department of Agriculture and Food, Perth Western Australia. April, 2012.

Department of Agriculture and Food Western Australia (DAFWA) (2012b). Native vegetation current extent – Western Australia (NVIS compliant version). July, 2012. Department of Agriculture and Food, Perth, Western Australia.

Department of Agriculture and Food Western Australia (DAFWA) (2014). Land System Mapping of Western Australia [shapefile]. Department of Agriculture and Food, Perth Western Australia. January, 2014.

Department of Agriculture and Food WA (DAFWA) (2016a). Natural Resource Management Info. Available: https://www.maps.agric.wa.gov.au/nrminfo/. Accessed: September 2016.

Department of Agriculture and Food WA (DAFWA) (2016b). Western Australian Organism List (WAOL). Available: https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol. Accessed: September 2016 to January 2017.

Department of Agriculture and Food WA (DAFWA) (2016c). Western Australian Organism List. BAM Act Definitions, Control Categories. Available: https://www.agric.wa.gov.au/organisms#legend. Accessed: Accessed: September 2016 to January 2017.

Department of Agriculture and Food WA (DAFWA) (2016d). Western Australian Organism List. Organism search. Available: https://www.agric.wa.gov.au/organisms. Accessed: September 2016 to January 2017.

Department of Environment and Conservation (DEC) (2013). Definitions, Categories and Criteria for Threatened and Priority Ecological Communities. January 2013. Available: https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf. Accessed: January 2017.

Department of Environment Regulation (DER) (2014). Clearing Regulations–Schedule 1 Areas (DER_014_4283_data_SHP, last updated 20140922) [shapefile]. Department of Environment Regulation, Perth City, Western Australia.

Department of Environment Regulation (DER) (2015). Clearing Regulations – Environmentally Sensitive Areas (ESA)(DER_016_4283_data_SHP; last updated 20151210) [shapefile]. Department of Environment Regulation, Perth City, Western Australia. Accessed and downloaded through Landgate..

Department of Mines and Petroleum (DMP) (2017). Current Mining Tenement Data (last updated 20170127) [ESRI shapefile]. Available: http://geodownloads.dmp.wa.gov.au/datacentre/datacentreDb.asp. Accessed: January 2017.

Department of Parks and Wildlife (DPaW) (2007-). NatureMap: Mapping Western Australia's Biodiversity. Department of Parks and Wildlife. Available: http://naturemap.dpaw.wa.gov.au/. Version: NatureMap V1.7.2.6. Accessed: September 2016 to January 2017.

Department of Parks and Wildlife (DPaW) (2014). EPA Redbook Recommended Conservation Reserves 1976-1991 (DPAW_025_4283_data_SHP, last updated 20141028) [shapefile]. Accessed and downloaded through Landgate.

Department of Parks and Wildlife (DPaW) (2015). Conservation Codes for Western Australian Flora and Fauna. November 11, 2015. Available: https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/conservation_code_definitions.pdf. Accessed: January 2017.

Department of Parks and Wildlife (DPaW) (2016a). DPaW Managed Lands and Waters (DPAW_026_4283_data_SHP, last updated 20161003) [shapefile]. Accessed and downloaded through Landgate.

Department of Parks and Wildlife (DPaW) (2016b). Results of Threatened Flora Search DPaW reference number 22-0916FL.

Department of Parks and Wildlife (DPaW) (2016c). Results of TEC/PEC Search DPaW reference number 14-0916EC.

Department of Parks and Wildlife (DPaW) (2016d). How does Parks and Wildlife manage weeds? Available: http://www.dpaw.wa.gov.au/plants-and-animals/plants/weeds/156-how-does-dpaw-manage-weeds. Accessed: December 2016.

Department of Parks and Wildlife (DPaW) (2016e). How does Parks and Wildlife manage weeds? Species-led ecological impact and invasiveness ranking summary results by region. Midwest Rankings Summary. Available: https://www.dpaw.wa.gov.au/plants-and-animals/plants/weeds/156-how-does-dpaw-manage-weeds. Accessed: December 2016.

Department of Parks and Wildlife (DPaW) (2016f). Priority Ecological Communities for Western Australia - Version 26. Species and Communities Branch, Department of Parks and Wildlife, 30 November 2016. Available: https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/priority_ecological_commuity_list_wa_version_26.pdf. Accessed: January 2017.

Department of Parks and Wildlife (DPaW) (2016g). List of Threatened Ecological Communities Endorsed by the Minister for the Environment. Species and Communities Branch (Correct as at 6 October 2016). Available: https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/threatened_ecological_communities_endorsed_by_the_minister_october_2016.pdf. Accessed: January 2017.

Department of Planning (DoP) (2016). Aboriginal Settlement – Wetlands (DOP_051_4283_data_SHP; last updated 20160120) [shapefile]. Department of Planning Perth City, Western Australia. Accessed and downloaded through Landgate.

Department of the Environment (DotE) (2010). Directory of Important Wetlands in Australia (DIWA) Spatial Database [shapefile] (last updated 20100323). Available: http://www.environment.gov.au/fed/catalog/search/resource/details.page?uuid=%7BE6C815D9-FB67-4372-AC25-81C7473CCD21%7D. Accessed: February 2016.

Department of the Environment and Energy (DotEE) (2012). Interim Biogeographic Regionalisation for Australia v. 7 (IBRA) [ESRI shapefile] Available: http://www.environment.gov.au/fed/catalog/search/resource/details.page?uuid=%7B3C182B5A-C081-4B56-82CA-DF5AF82F86DD%7D. Accessed: January 2017.

Department of the Environment and Energy (DotEE) (2016a). Australia's Bioregions. Available: http:// http://www.environment.gov.au/land/nrs/science/ibra. Accessed: September 2016.

Department of the Environment and Energy (DotEE) (2016b). Ramsar Wetlands of Australia [shapefile] (last updated 20160216). Available: http://www.environment.gov.au/fed/catalog/search/resource/details.page?uuid=%7B3F208CDF-28ED-4B1F-B965-A733EB58D952%7D. Accessed: November 2016.

Department of the Environment and Energy (DotEE) (2016c). EPBC Act Protected Matters Search Tool. Available: http://www.environment.gov.au/topics/about-us/legislation/environment-protection-and-biodiversity-conservation-act-1999/protected. Accessed: September 2016.

Department of the Environment and Energy (DotEE) (2016d). Threatened Species Scientific Committee Guidelines for assessing the conservation status of native species according to the Environment Protection and Biodiversity Conservation Act 1999 and Environment Protection and Biodiversity Conservation Regulations 2000. Available: https://www.environment.gov.au/system/files/pages/d72dfd1a-f0d8-4699-8d43-5d95bbb02428/files/tssc-guidelines-assessing-species-2015.pdf. Accessed: January 23 2017.

Desmond, A., Kendrick, P., and Chant, A. (2001). Gascoyne 3 (GAS3 – Augustus subregion). In: A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002. Department of Conservation and Land Management.

Environmental Protection Authority (EPA) (2002). EPA Position Statement 3, Terrestrial Biological Surveys as an element of Biodiversity Protection. EPA, Perth, Western Australia.

Environmental Protection Authority (EPA) (2004). Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia. EPA, Perth, Western Australia.

Environmental Protection Authority (EPA) and Department of Parks and Wildlife (DPaW) (2015). Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment (eds.: K. Freeman, G. Stack, S. Thomas and N. Woolfrey), Perth, Western Australia.

Executive Steering Committee for Australian Vegetation Information (ESCAVI) (2003). Australian Vegetation Attribute Manual: National Vegetation Information System, Version 6.0. Department of the Environment and Heritage, Canberra.

Government of Western Australia (GoWA)) (2015). 2015 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of June 2015. WA Department of Parks and Wildlife, Perth. https://www2.landgate.wa.gov.au/web/guest/downloader.

Government of Western Australia (GoWA) (2017). Wildlife Conservation (Rare Flora) Notice 2017. Western Australian Government Gazette, No. 4, 6 January 2017, pp 69-75.

Jones, A. (2015). Threatened and Priority Flora List, 11 November 2015. Department of Parks and Wildlife: Kensington, WA.

Maia (2015). RNI NL: Tenements E52/1659 and E52/1671 Level 1 Flora and Vegetation Assessment and Targeted Flora Survey, August 2014. Unpublished report for RNI NL, January 2015.

Maia (2016). Metals X Limited: Nathans Survey Area (Tenements M52/95, M52/96, M52/98, M52/99 and P52/1510). Level 1 Flora and Vegetation Assessment and Targeted Flora Survey, December 2016. Unpublished report for Metals X Limited, December 2016.

Meissner, R., Owen, G. and Bayliss, B. (2009). Flora and vegetation of the banded iron formation of the Yilgarn Craton: Robinson Ranges and Mount Gould. Conservation Science W. Aust. 7(2): 363-376.

Microsoft Corporation. (2016). Bing Maps Aerial. Accessed: ArcGis Online, September to December, 2016.

Rye, B.L. (2007). New species and keys for *Cryptandra* and *Stenanthemum* (Rhamnaceae) in Western Australia. Nuytsia, 16(2), pp 325-382.

Stewart, A.J., Sweet, I.P., Needham, R.S., Raymond, O.L., Whitaker, A.J., Liu, S.F., Phillips, D., Retter, A.J., Connolly, D.P., and Stewart, G. (2008). Surface geology of Australia 1:1,000,000 scale, Western Australia [Digital Dataset]. Canberra: The Commonwealth of Australia, Geoscience Australia. http://www.ga.gov.au. Accessed and downloaded through Landgate (March, 2012).

Tille (2006). Soil-landscapes of Western Australia's Rangelands and Arid Interior - Resource Management Technical Report 313. Department of Agriculture and Food, Government of Western Australia.

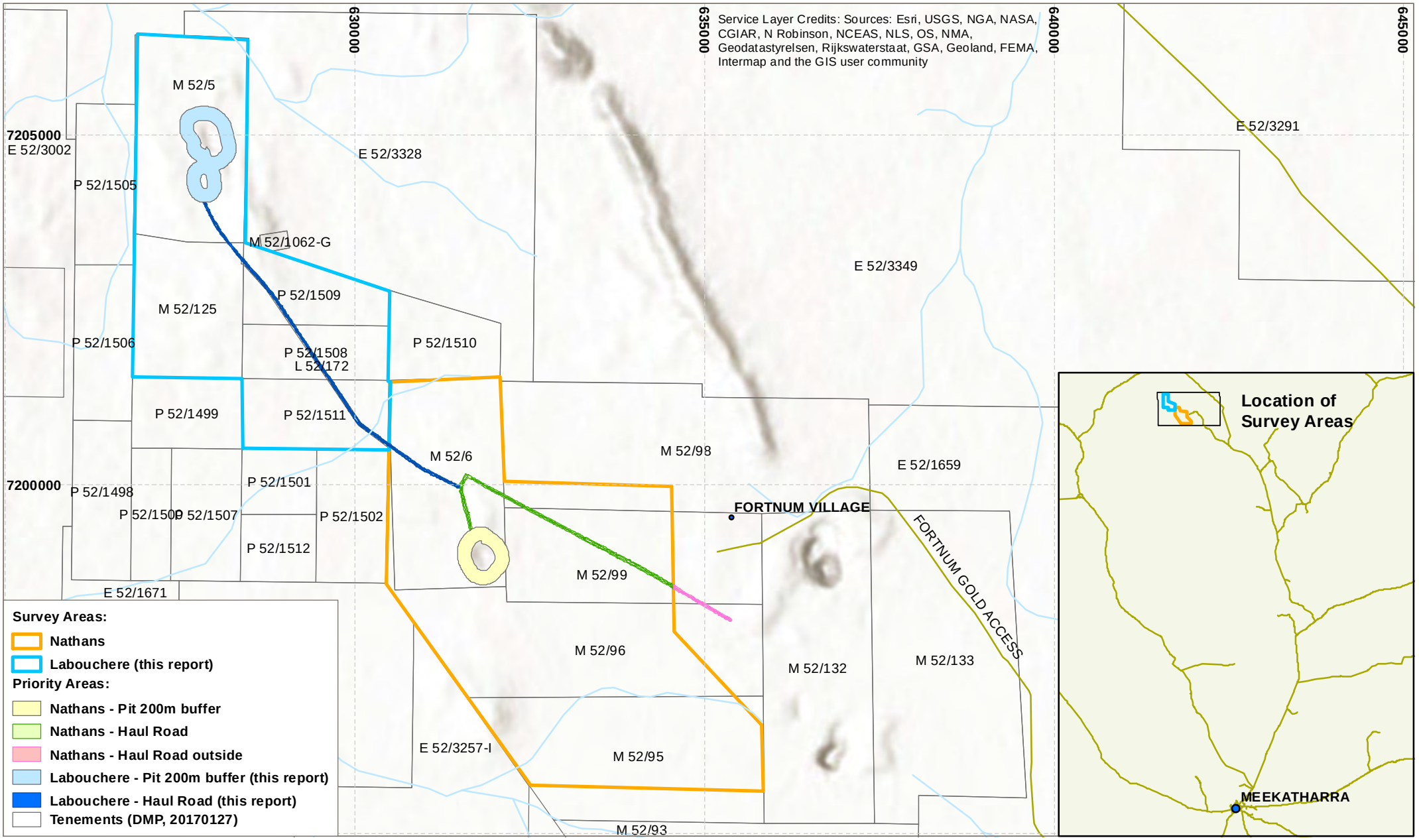
Umwelt (Australia) Pty Limited (Umwelt) (2012). Fortnum Gold Mine. Application for a Clearing Permit (Purpose): Tom's (M52/132, M52/133), Yarlarweelor (M52/132, M52/133), Callie's (M52/95, M52/133), TSF 3 (M52/96, M52/99, M52/132). Report prepared for Grosvenor Gold Pty Ltd, November 2012.

Umwelt (Australia) Pty Limited (Umwelt) (2013). Horseshoe Gold Mine Level 1 Flora and Fauna Survey. Mining Leases 52/251, 52/338 and Miscellaneous Lease 52/102. Final. August 2013. Unpublished report prepared for Grosvenor Gold Pty Ltd.

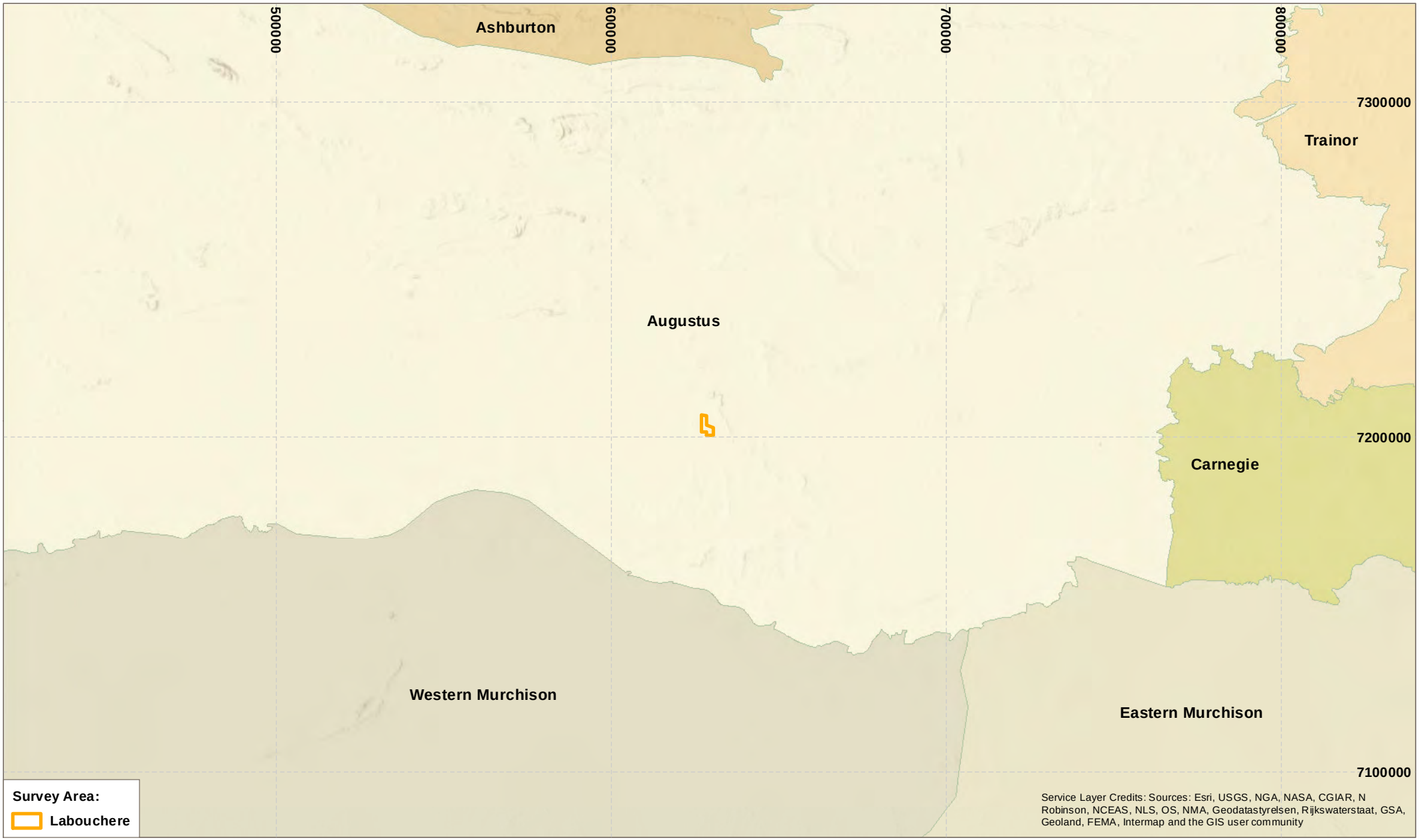
Western Australian Herbarium (WAH) (1998 -). FloraBase - the Western Australian Flora. Department of Parks and Wildlife. Available: http://florabase.dpaw.wa.gov.au/. Version: 2.9.12. Accessed: September 2016 to January 2017.

9 MAPS

This page is intentionally blank.


Service Layer Credits: Sources: Esri, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community
630000
635000
640000
645000
7205000
7200000
E 52/3002
E 52/3328
E 52/3291
E 52/3349
E 52/1659
E 52/1671
E 52/3257-I
M 52/5
M 52/1062-G
M 52/125
M 52/6
M 52/98
M 52/99
M 52/96
M 52/132
M 52/133
M 52/95
M 52/93
P 52/1505
P 52/1509
P 52/1506
P 52/1508
L 52/172
P 52/1510
P 52/1499
P 52/1511
P 52/1498
P 52/1501
P 52/1509
P 52/1507
P 52/1502
P 52/1512
FORTNUM VILLAGE
FORTNUM GOLD ACCESS
Location of Survey Areas
MEEKATHARRA
Survey Areas:
Nathans
Labouchere (this report)
Priority Areas:
Nathans - Pit 200m buffer
Nathans - Haul Road
Nathans - Haul Road outside
Labouchere - Pit 200m buffer (this report)
Labouchere - Haul Road (this report)
Tenements (DMP, 20170127)
Location Map
Port Hedland
Newman
Wiluna
Geraldton
Kalgoorlie
Perth
Places
Roads
Watercourse lines
General location
maia
N
0
1.5
Kilometres
Datum: GDA 1994, MGA 50
Map: 9.1
Prepared for: Metals X
Drawn by: RH
Date: 30/01/2017
Version: 2
Size: A4

This page is intentionally blank.



Location Map

IBRA Subregions

maia

N

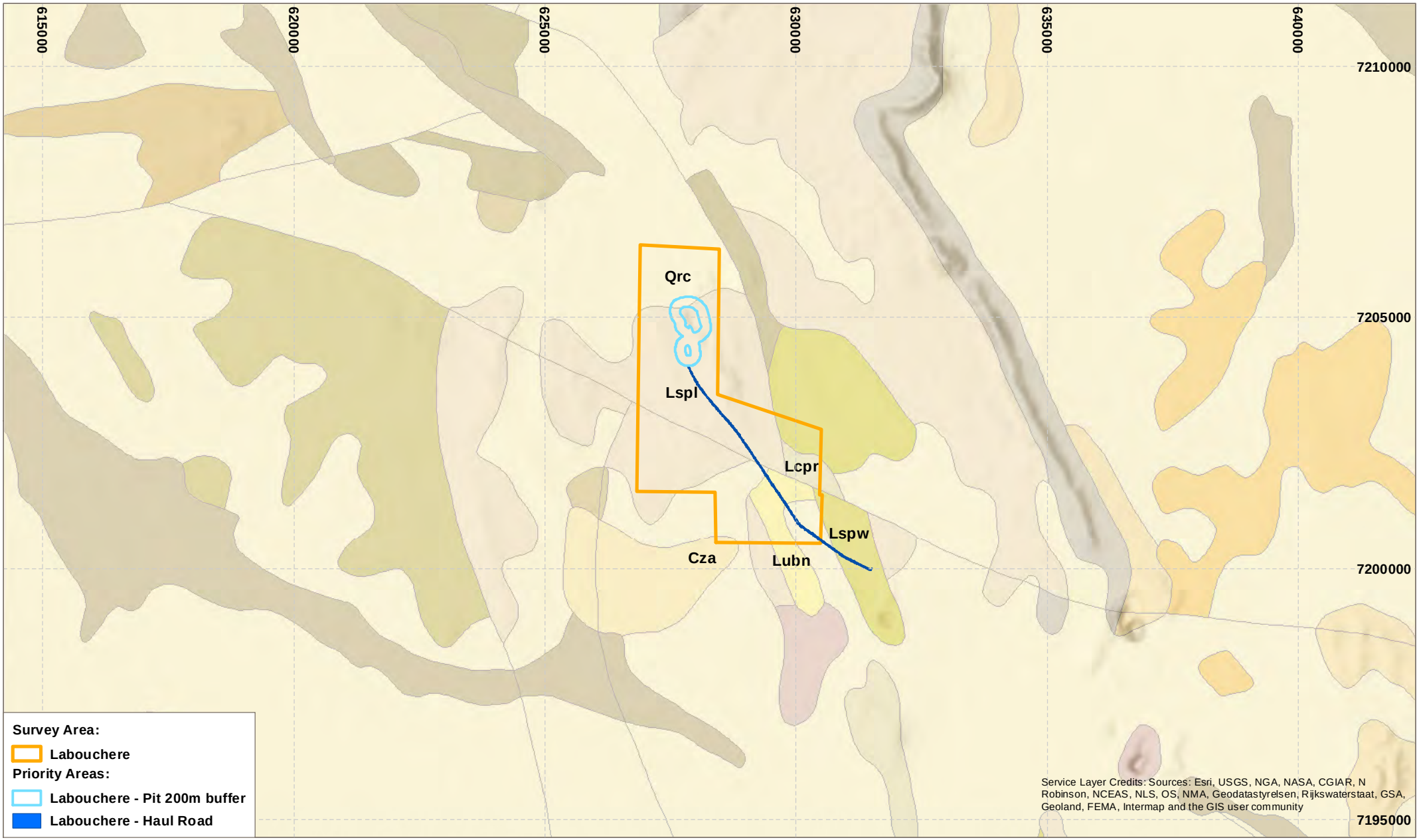
0 32.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.2
Prepared for: Metals X
Drawn by: RH
Date: 14/12/2016
Version: 1 **Size:** A4

This page is intentionally blank.



Location Map

Geology

maia

N

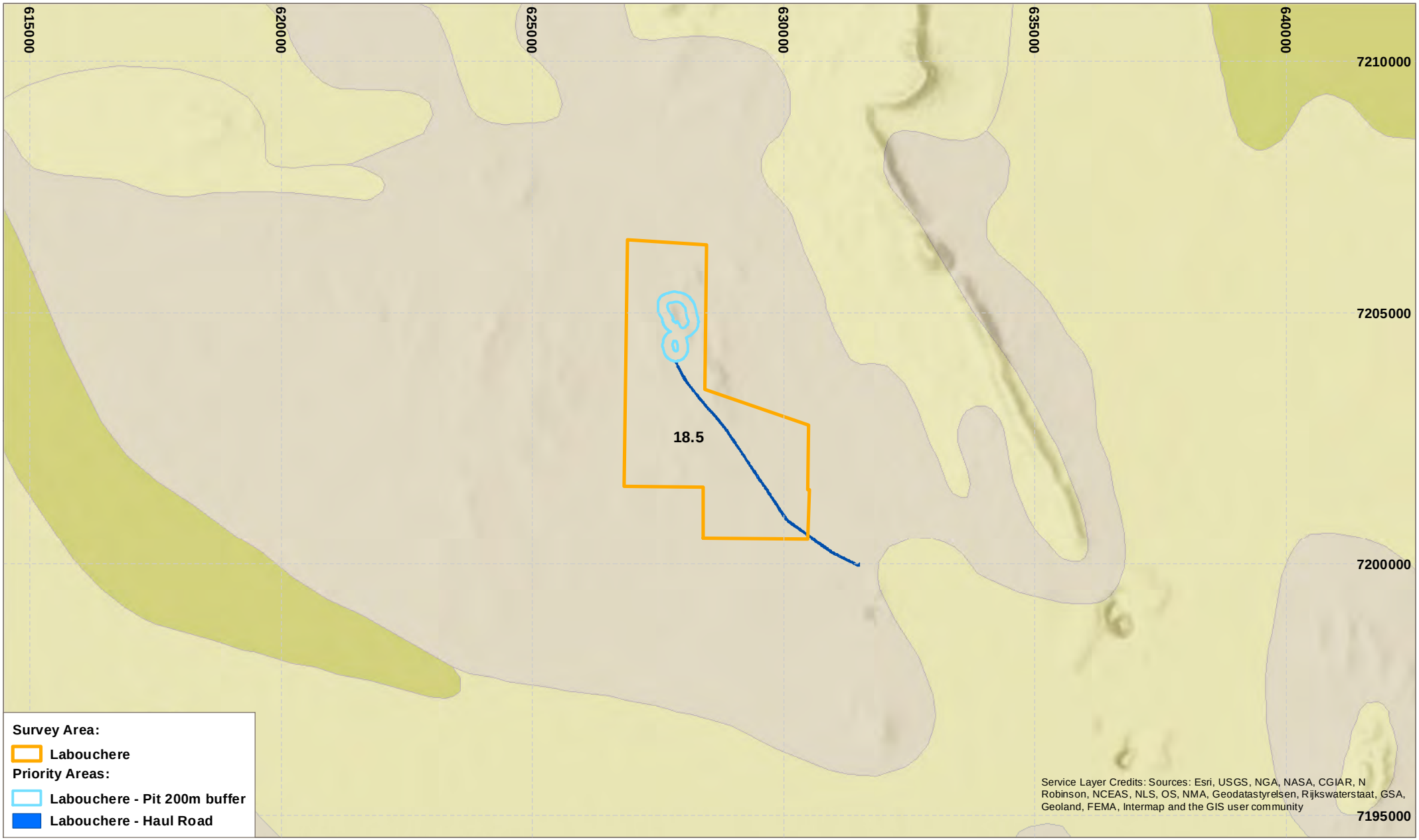
0 2

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.3
Prepared for: Metals X
Drawn by: RH
Date: 14/12/2016
Version: 1 **Size:** A4

This page is intentionally blank.



Location Map

Beard's pre-European vegetation mapping (vegetation system associations)

maia

N

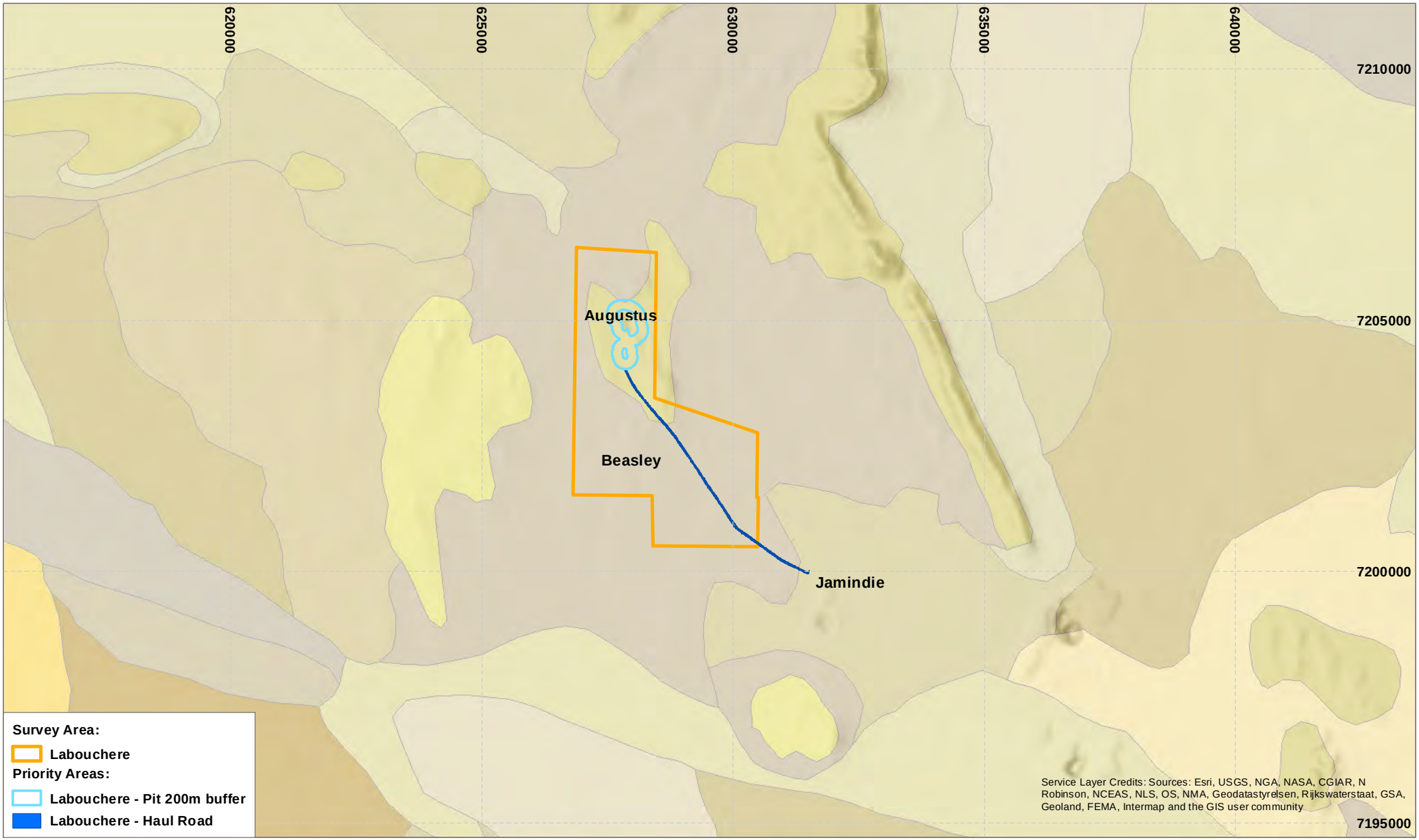
0 2

Kilometres

Datum: GDA 1994, MGA 50

Map:	9.4
Prepared for:	Metals X
Drawn by:	RH
Date:	14/12/2016
Version:	1 **Size:** A4

This page is intentionally blank.



Location Map

Land systems

N

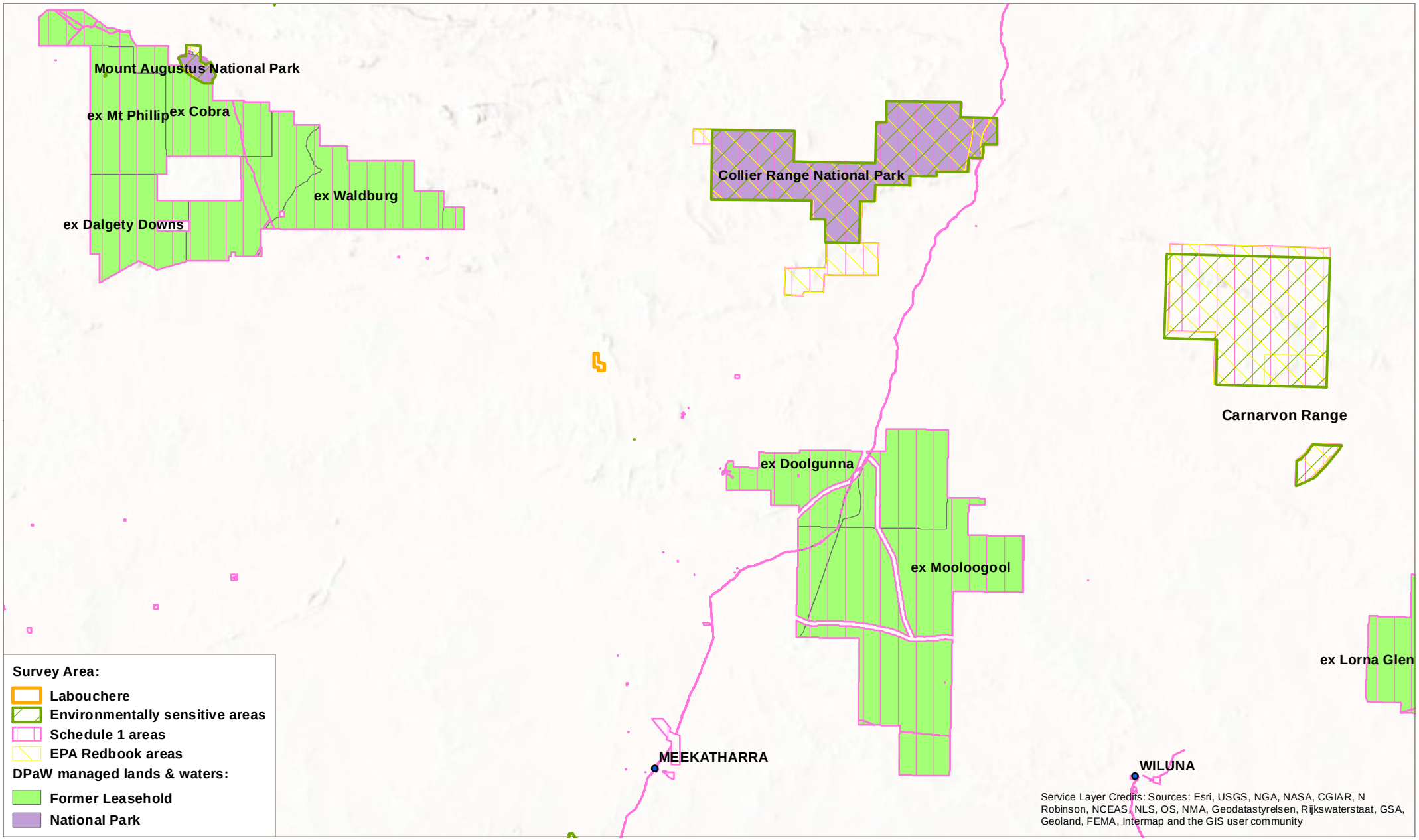
0 2

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.5
Prepared for: Metals X
Drawn by: RH
Date: 14/12/2016
Version: 1 **Size:** A4

This page is intentionally blank.



Location Map

Places

Environmentally sensitive areas, DPaW managed lands, Schedule 1 areas and EPA Redbook areas

maia

N

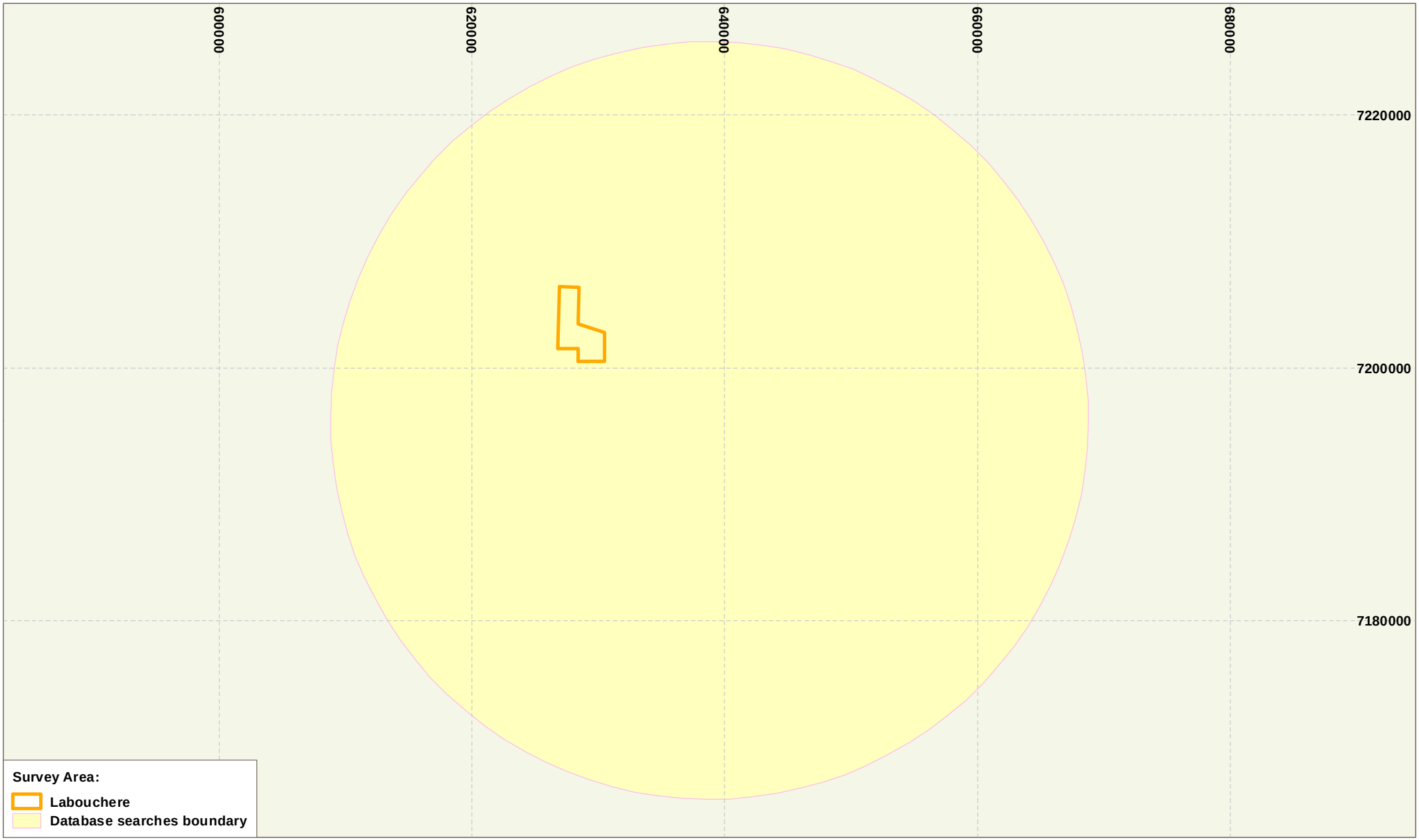
0 40

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.6
Prepared for: Metals X
Drawn by: RH
Date: 14/12/2016
Version: 1 **Size:** A4

This page is intentionally blank.



Location Map

Database searches area

maia

N

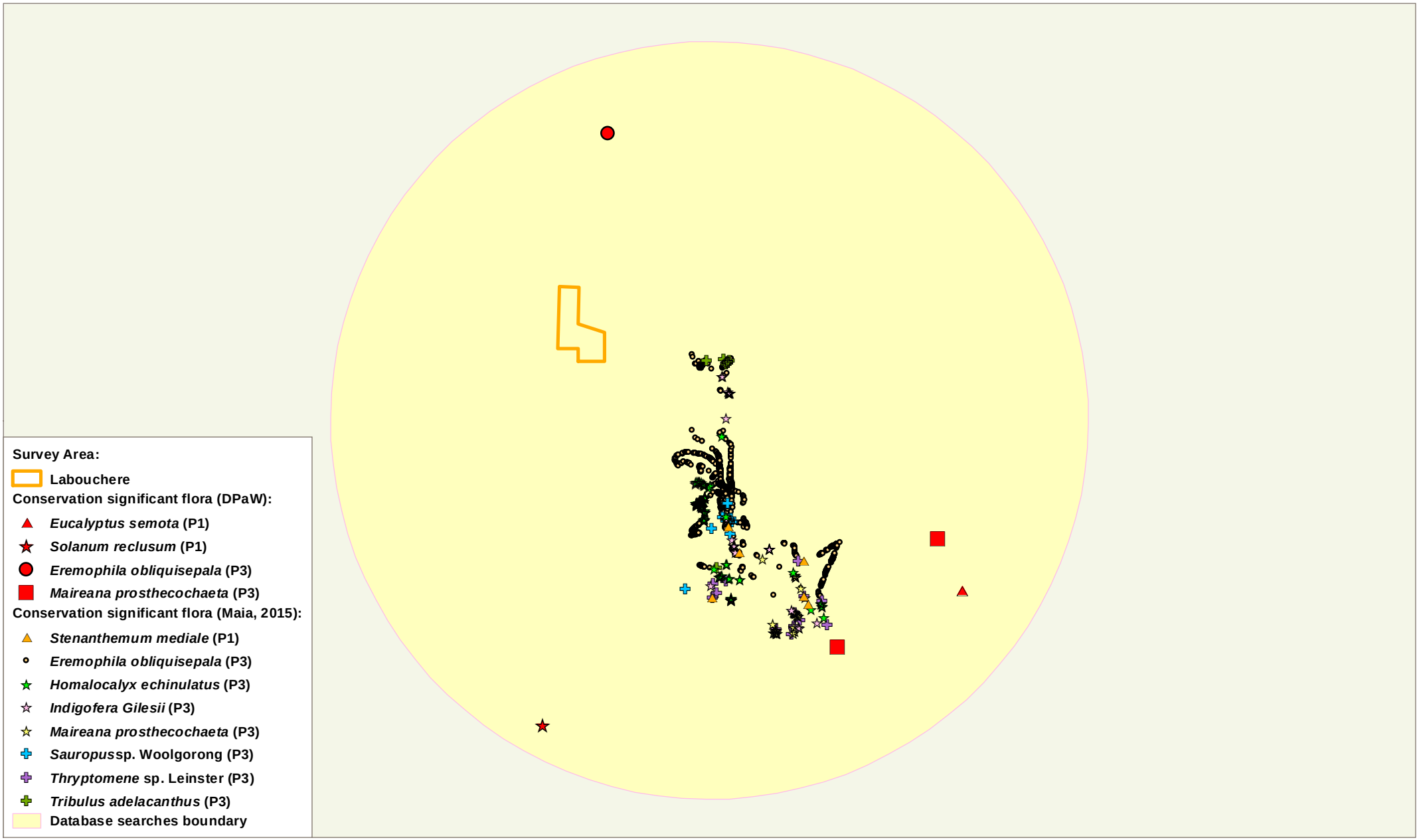
0 7.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.7
Prepared for: Metals X
Drawn by: RH
Date: 14/12/2016
Version: 1 **Size:** A4

This page is intentionally blank.

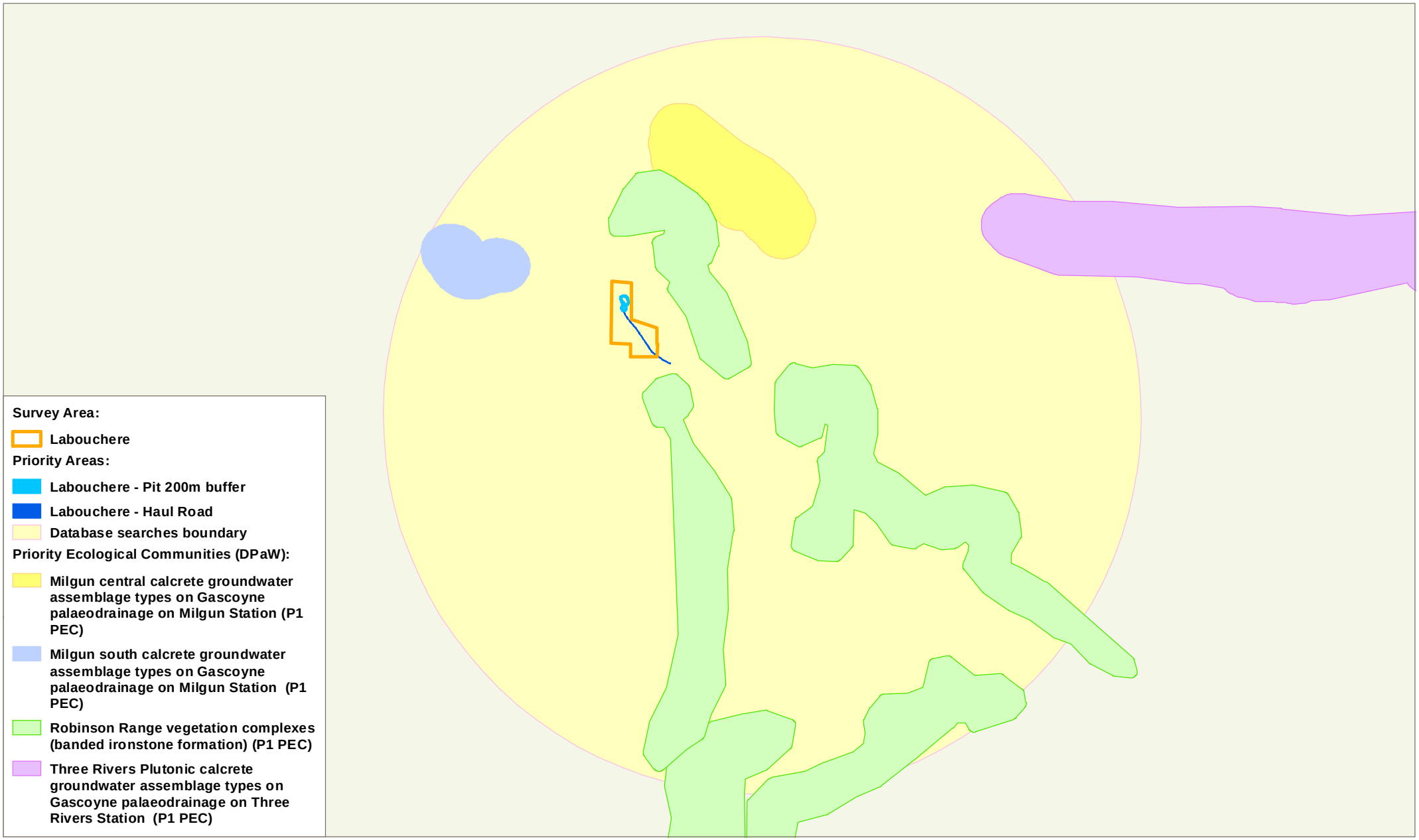


Conservation significant flora
(DPaW search reference #22-0916FL; Maia, 2015)

N
0 7.5
Kilometres
Datum: GDA 1994, MGA 50

Map: 9.8
Prepared for: Metals X
Drawn by: RH
Date: 14/12/2016
Version: 1 **Size:** A4

This page is intentionally blank.



Priority Ecological Communities
(DPaW search reference #14-0916EC)

maia

N

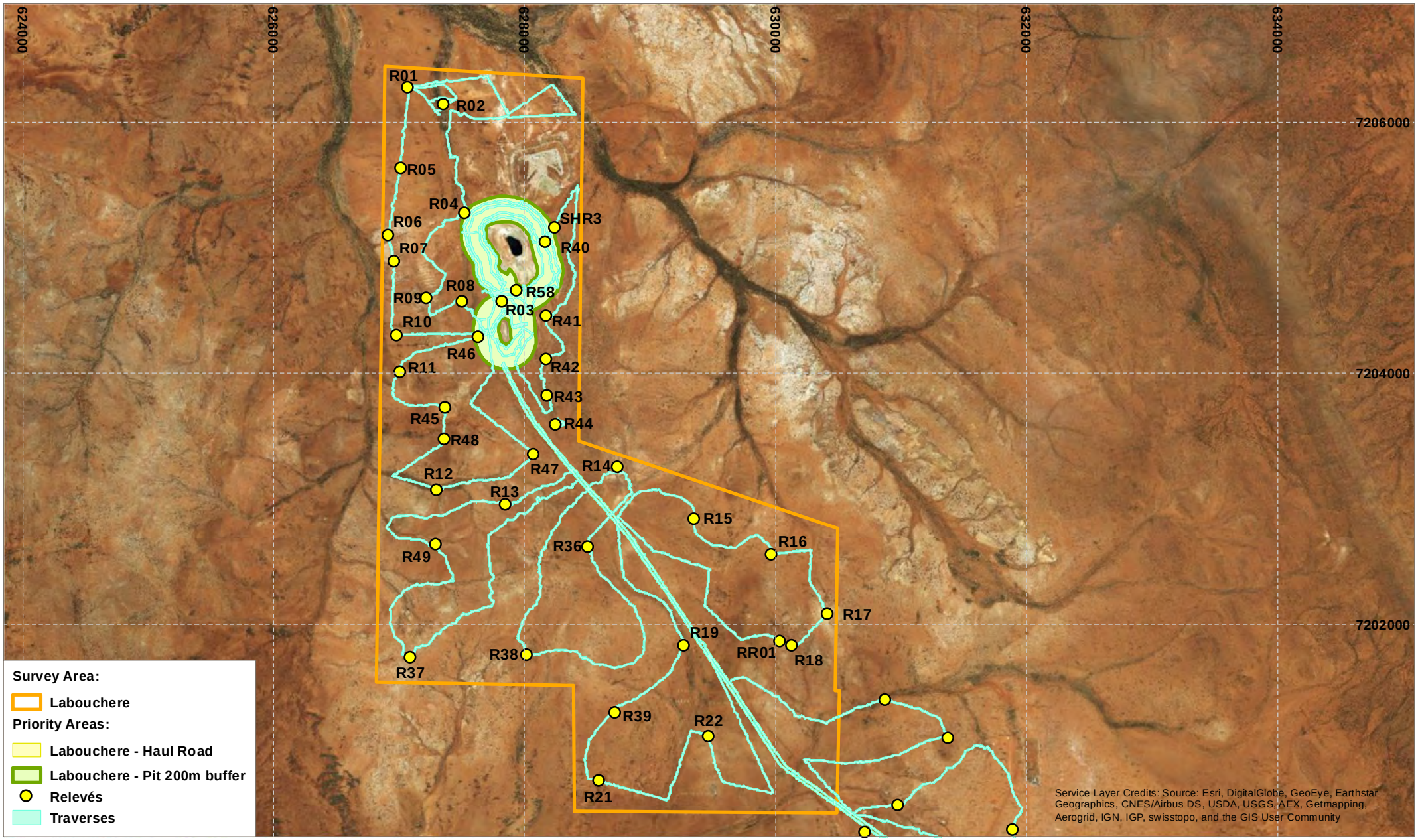
0 7.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.9
Prepared for: Metals X
Drawn by: RH
Date: 14/12/2016
Version: 1 **Size:** A4

This page is intentionally blank.



Location Map

Relevés and traverses

N

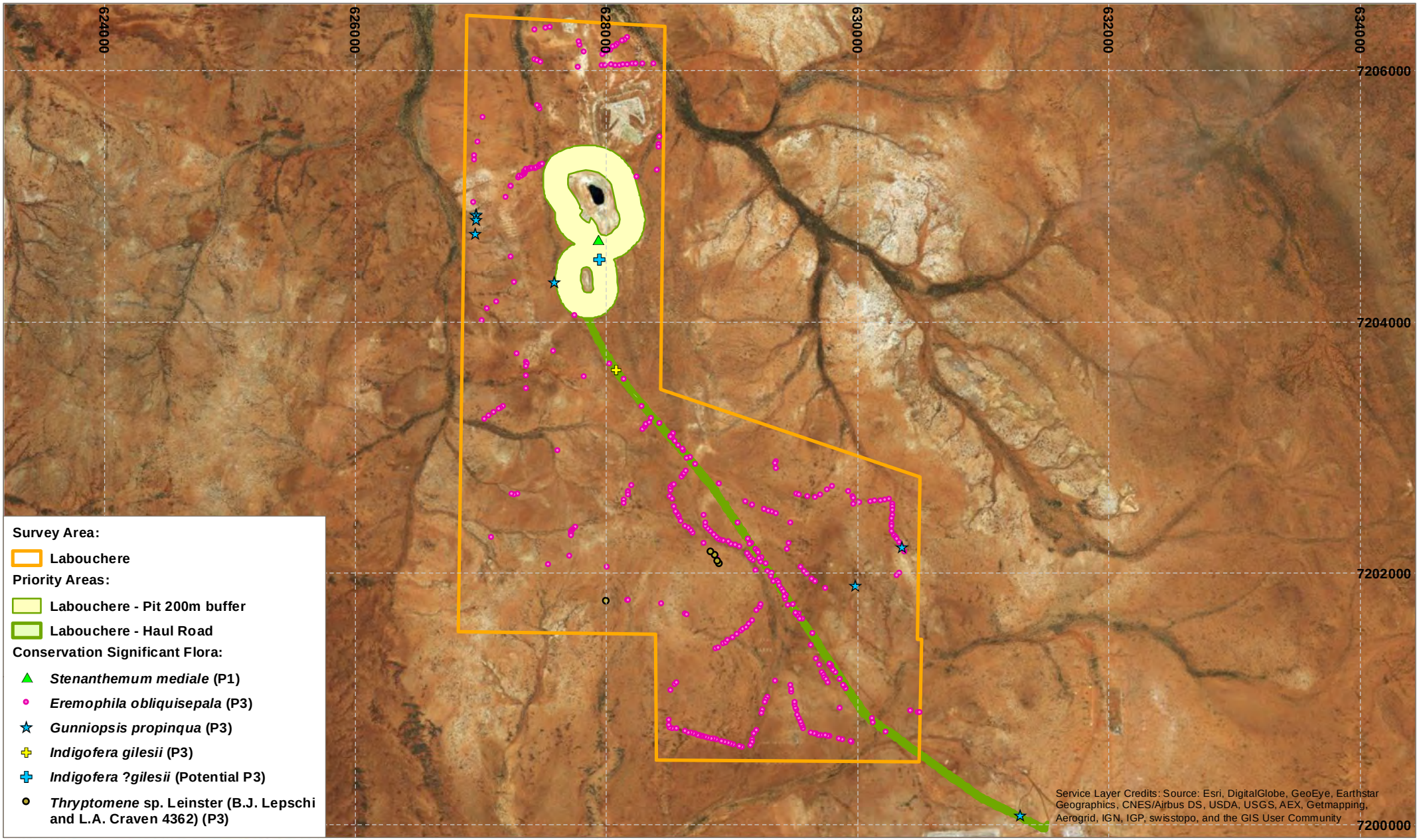
0 0.75

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.10
Prepared for: Metals X
Drawn by: RH
Date: 19/12/2016
Version: 1 **Size:** A4

This page is intentionally blank.



Location Map

Conservation significant flora

maia

N

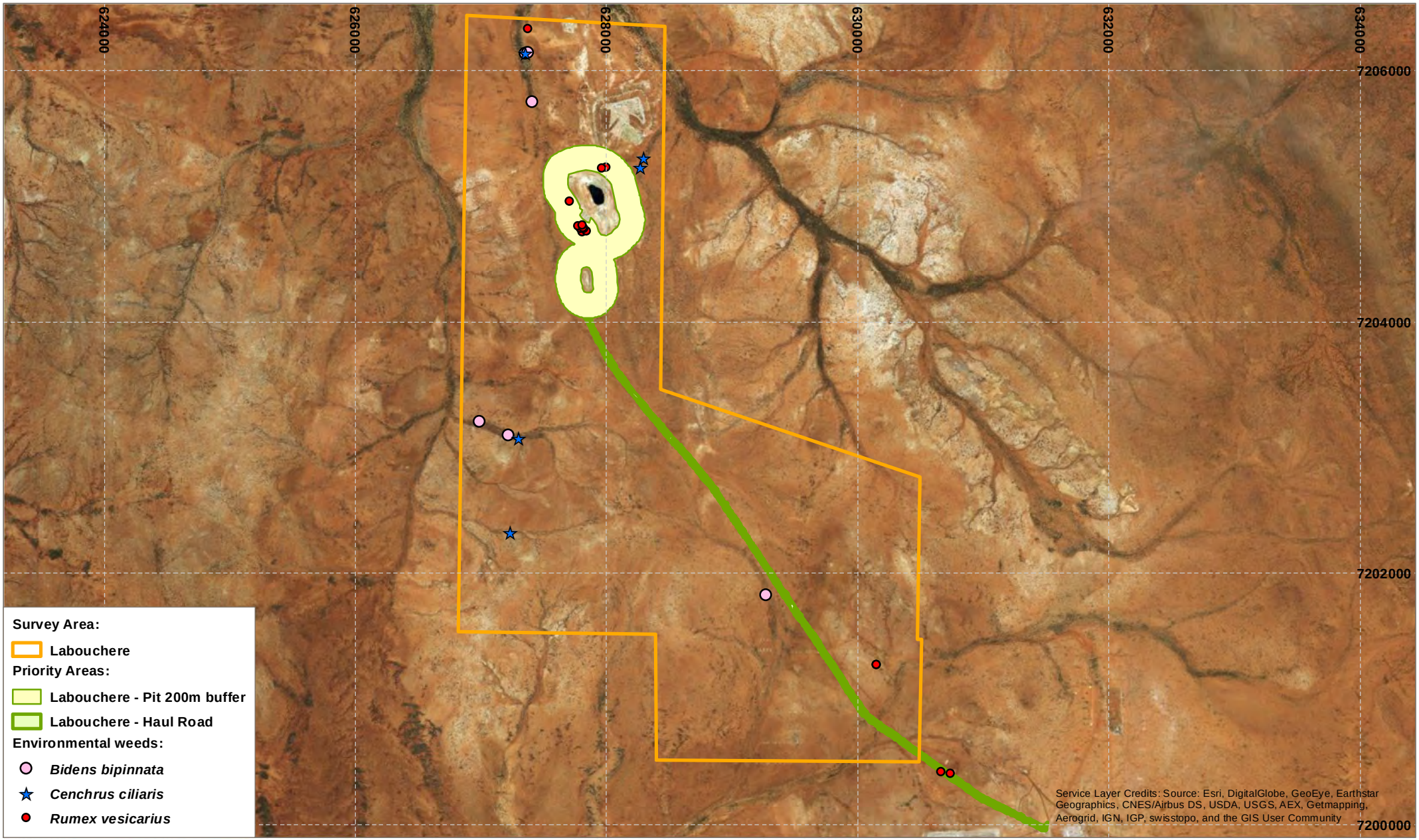
0 0.75

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.11
Prepared for: Metals X
Drawn by: RH and SH
Date: 19/12/2016
Version: 4 **Size:** A4

This page is intentionally blank.



Location Map

Weeds

N

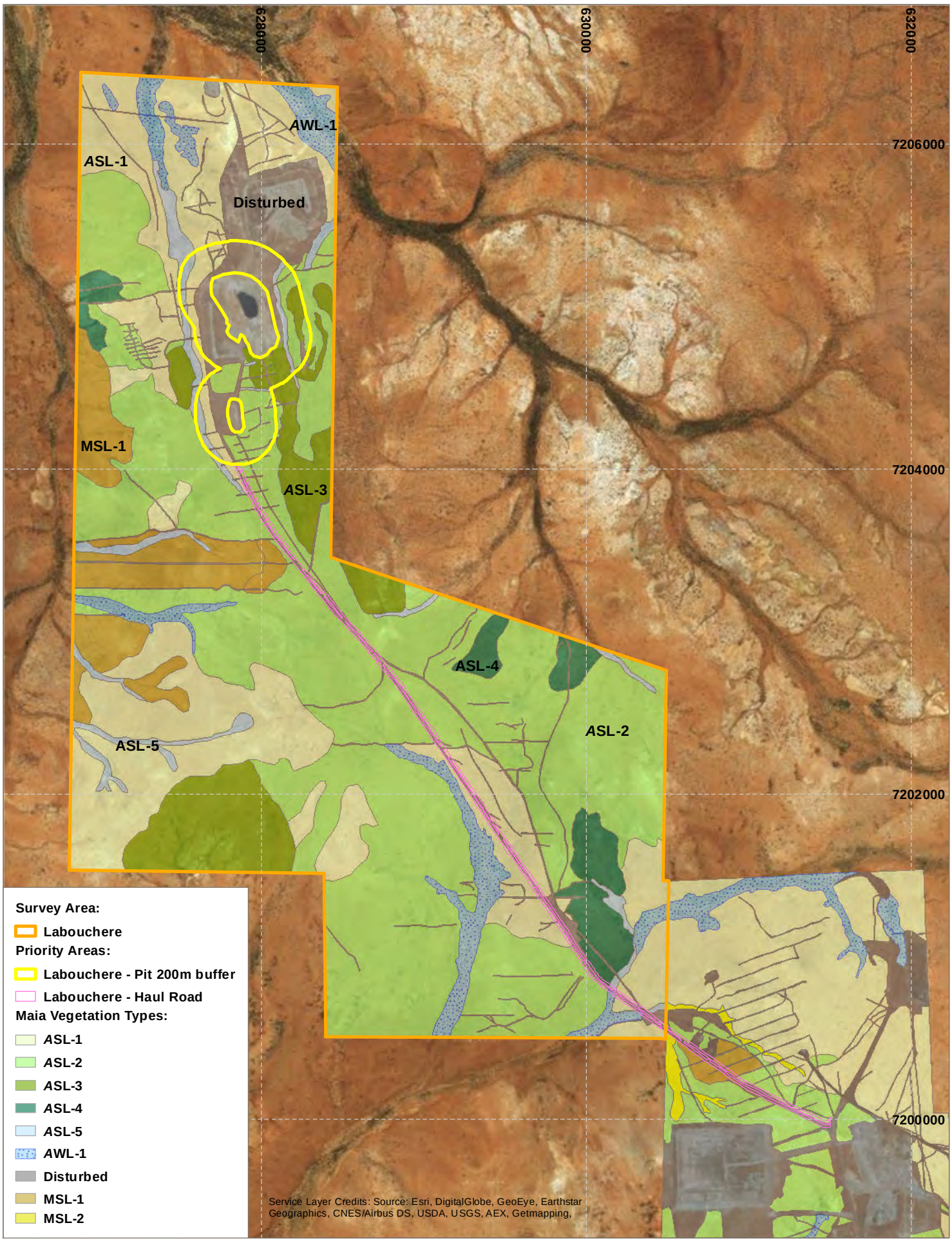
0 0.75

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.12
Prepared for: Metals X
Drawn by: RH and SH
Date: 19/12/2016
Version: 4 **Size:** A4

This page is intentionally blank.



maia

Location Map

Maia vegetation types

N

0 0.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.13

Prepared for: Metals X

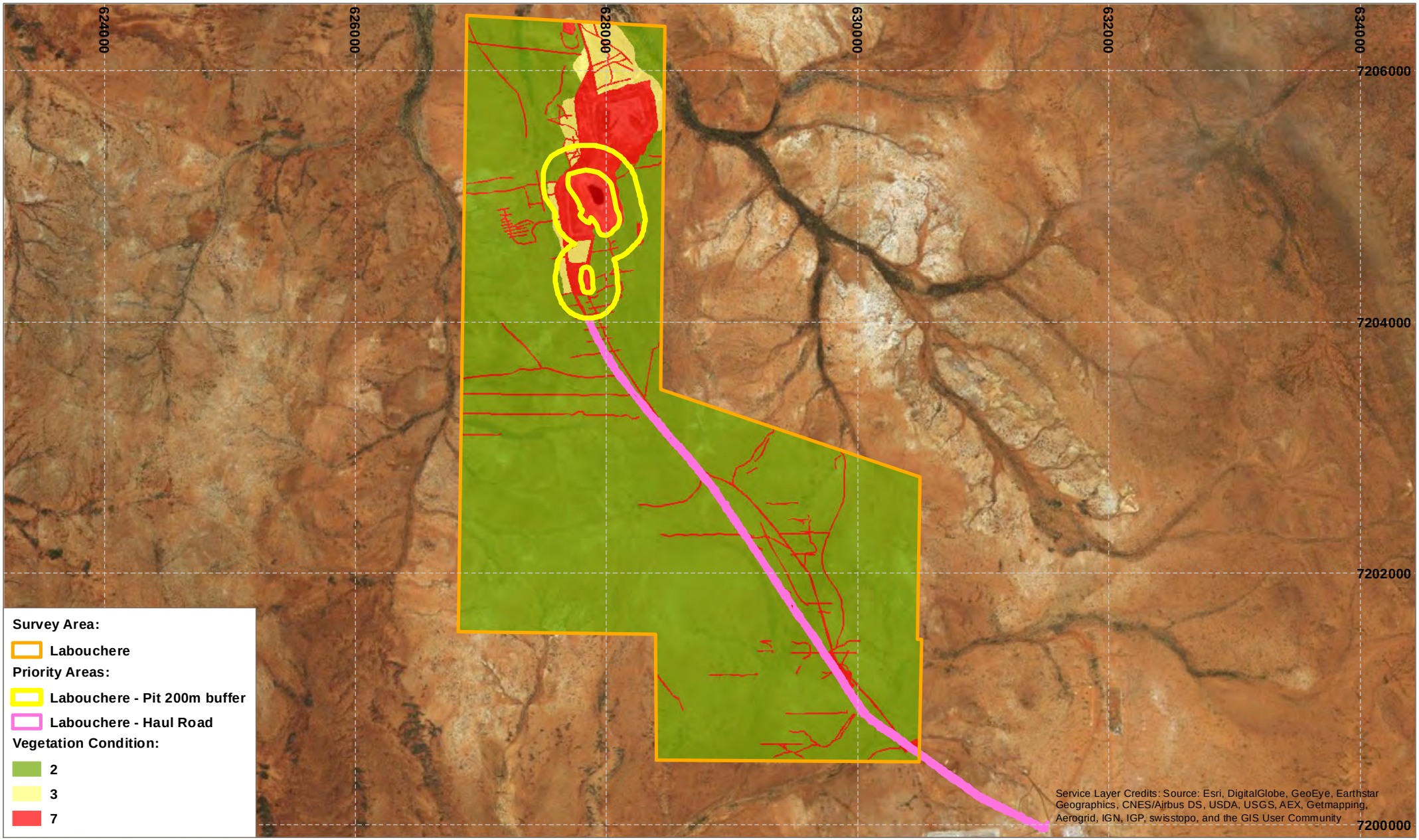
Drawn by: RH

Date: 19/12/2016

Version: 1 **Size:** A4

Table 9.1: Vegetation types, map colours and descriptions

ASL-1	**Sparse Tall *Acacia* Shrubland of either *Acacia incurvaneura* or *A. aptaneura* with a Sparse mixed Low Shrubland (*Eremophila phyllopoda*, *Ptilotus schwartzii*, and *Scaevola spinescens*) and Isolated Low Trees of *Acacia pruinocarpa* and / or *A. citrinoviridis*.**
ASL-2	**Sparse Tall Shrubland of *Acacia incurvaneura* and / or *A. rhodophloia* with a mixed Sparse Low Shrubland (*Eremophila jucunda* subsp. *jucunda*, *E. obliquisepala* (P3), *Ptilotus schwartzii*) and Isolated Low Trees of either *Grevillea berryana*, *Acacia citrinoviridis* or *A. pruinocarpa*.**
ASL-3	**Open Tall Shrubland of *Acacia Incurvaneura* or *A. aptaneura* with a mixed Low Open Shrubland (*Eremophila latrobei* subsp. *latrobei*, *E. jucunda* subsp. *jucunda* and *Dodonaea pachyneura*) and +/- Scattered Mallee Trees of *Corymbia ferriticola*.**
ASL-4	**Sparse Tall Shrubland of *Acacia aptaneura* and / or *A. xiphophylla* with a Sparse Low Shrubland of *Senna artemisioides* subsp. *oligophylla* x *helmsii* and *Solanum lasiophyllum* and a Sparse Chenopod Shrubland of *Sclerolaena eriacantha*, *Maireana georgei* and *Maireana villosa*.**
ASL-5	**Open Tall Shrubland of *Acacia cuthbertsonii* subsp. *cuthbertsonii*, +/- *A. incurvaneura* or *A. rhodophloia* with a Sparse mixed Low Shrubland (*Dodonaea petiolaris*, *Eremophila glutinosa* and *E. exilifolia*) and Isolated Low Trees of *Acacia citrinoviridis* and / or *Grevillea berryana*.**
AWL-1	**Low Woodland to Low Open Forest of *Acacia incurvaneura*, *A. aptaneura* and *A. cyperophylla* var. *cyperophylla* with a mixed Tall Shrubland (*Acacia cuthbertsonii* subsp. *cuthbertsonii*, *A. ramulosa* var. *linophylla*, *Eremophila forrestii* subsp. *forrestii*) and a mixed Low Shrubland (*Indigofera monophylla*, *Abutilon cryptopetalum*, and *Enchylaena tomentosa* var. *tomentosa*).**
Disturbed	
MSL-1	**Sparse mixed Shrubland (*Senna glaucifolia*, *Eremophila phyllopoda* and *Ptilotus rotundifolius*) and a Sparse to Open Tussock Grassland of *Aristida contorta*.**
MSL-2	**Sparse mixed Low Shrubland (*Pluchea dentex*, *Grevillea deflexa* and *Calytrix desolata*) with Isolated Low Trees of *Acacia citrinoviridis*.**



Location Map

Vegetation condition

maia

N

0 0.75

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.14
Prepared for: Metals X
Drawn by: RH and SH
Date: 19/12/2016
Version: 4 **Size:** A4

This page is intentionally blank.

APPENDIX 1: DATABASE SEARCH RESULTS

Figure A1.1: EPBC Act Protected Matters Search Tool results (DotEE, 2016c)

Australian Government
Department of the Environment

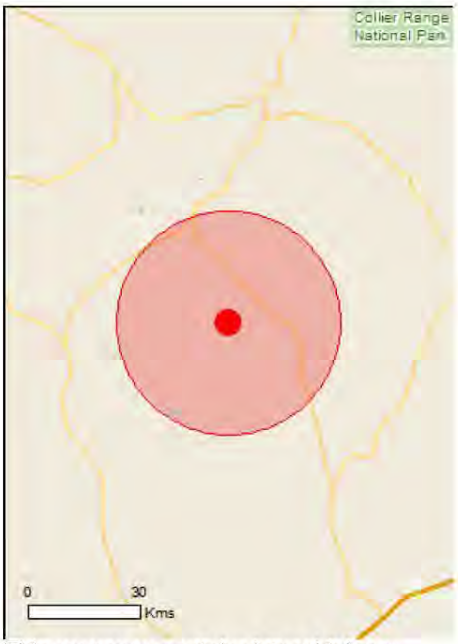
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

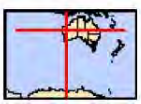
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 14/09/16 10:24:37



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 30.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	3
Listed Migratory Species:	4

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	6
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	9
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat may occur within area
Plants		
Pityrodia augustensis		
Mt Augustus Foxglove [4962]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Terrestrial Species		
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area

Extra Information

Invasive Species		[Resource Information]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.		
Name	Status	Type of Presence
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-25.34778 118.37917

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Figure A1.2: NatureMap search results (DPaW, 2007-)

NatureMap
Mapping Western Australia's biodiversity

1607 NatureMap ConsRank

Created By Guest user on 13/09/2016

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 118° 22' 45" E,25° 20' 52" S
Buffer 30km
Group By Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	103	192
Priority 1	2	5
Priority 3	2	3
TOTAL	107	200

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Priority 1					
1.	15599	*Eucalyptus semota*		P1	
2.	42540	*Solanum reclusum*		P1	Y
Priority 3					
3.	19631	*Eremophila obliquisepala*		P3	
4.	2559	*Maireana prosthecochaeta*		P3	
Non-conservation taxon					
5.	3217	*Acacia aneura (Mulga, Wanari)*			
6.	3260	*Acacia citrinoviridis*			
7.	14088	*Acacia cyperophylla var. cyperophylla*			
8.	36418	*Acacia incurvaneura*			
9.	3399	*Acacia kempeana (Witchetty Bush, Ilykuwara)*			
10.	3435	*Acacia marramamba*			
11.	3500	*Acacia pruinocarpa (Gidgee)*			
12.	29015	*Acacia pyrifolia var. pyrifolia*			
13.	3519	*Acacia rhodophloia*			
14.		*Acacia sp.*			
15.	3577	*Acacia tetragonophylla (Kurara, Wakalpuka)*			
16.	19470	*Aluta maisonneuvei subsp. auriculata*			
17.	207	*Aristida contorta (Bunched Kerosene Grass)*			
18.	16369	*Atriplex canescens*	Y		
19.	242	*Brachyachne prostrata*			
20.	7413	*Brunonia australis (Native Cornflower)*			
21.	750	*Bulbostylis barbata*			
22.	5451	*Calytrix desolata*			
23.	7922	*Cephalipterum drummondii (Pompom Head)*			
24.	12818	*Cheilanthes sieberi subsp. sieberi*			
25.	273	*Chrysopogon fallax (Golden Beard Grass)*			
26.		*Chrysopogon sp.*			
27.	2988	*Cleome viscosa (Tickweed, Tjinduwadhii)*			
28.	16780	*Corymbia candida subsp. dipsodes*			
29.	17077	*Corymbia ferriticola*			
30.	41721	*Cucumis variabilis*			
31.	17117	*Cullen cinereum*			
32.	12797	*Cyperus centralis*			
33.	809	*Cyperus rigidellus*			
34.	6962	*Datura leichhardtii (Native Thornapple)*	Y		
35.	31838	*Dicrastylis kumarinensis*			
36.	4772	*Dodonaea pachyneura*			
37.	4773	*Dodonaea petiolaris*			
38.	2502	*Dysphania kalpari (Rat's Tail, Kalpari)*			
39.	11890	*Dysphania rhadinostachya subsp. rhadinostachya*			

NatureMap is a collaborative project of the Department of Parks and Wildlife and the Western Australian Museum.

Page 1

NatureMap
Mapping Western Australia's biodiversity

	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
40.	15052	*Eremophila forrestii subsp. forrestii*			
41.	7211	*Eremophila georgei*			
42.	7216	*Eremophila glutinosa*			
43.	17171	*Eremophila jucunda subsp. jucunda*			
44.	17576	*Eremophila latrobei subsp. latrobei*			
45.	17190	*Eremophila spectabilis subsp. spectabilis*			
46.	7273	*Eremophila strongylophylla*			
47.	408	*Eriachne flaccida (Claypan Grass)*			
48.	417	*Eriachne pulchella (Pretty Wanderrie)*			
49.	16485	*Eriachne pulchella subsp. dominii*			
50.	425	*Eriochloa procera (Cupgrass)*			
51.	35303	*Euphorbia australis var. subtomentosa*			
52.	4620	*Euphorbia boophthona (Gascoyne Spurge)*			
53.		*Fossombronia sp.*			
54.	5203	*Frankenia hispidula*			
55.	12574	*Goodenia prostrata*			
56.	7556	*Goodenia tenuiloba*			
57.	7558	*Goodenia triodiophila*			
58.	15916	*Halgania sp. A Kimberley Flora (H.A. Johnson 5123)*			
59.	16371	*Haloragis odontocarpa forma pterocarpa*			
60.	11440	*Haloragis odontocarpa forma rugosa*			
61.	6710	*Heliotropium europaeum (Common Heliotrope)*	Y		
62.	4941	*Hibiscus solanifolius*			
63.	11893	*Hibiscus sturtii var. truncatus*			
64.		*Indigofera sp.*			
65.	13289	*Lawrencella davenportii*			
66.	19126	*Leptochloa fusca subsp. muelleri*			
67.	4061	*Lotus cruentus (Redflower Lotus)*			
68.	2557	*Maireana platycarpa (Shy Bluebush)*			
69.	2560	*Maireana pyramidata (Sago Bush)*			
70.		*Maireana sp.*			
71.	490	*Monachather paradoxus*			
72.	4110	*Muelleranthus stipularis*			
73.	494	*Neurachne minor*			
74.	505	*Panicum laevinode*			
75.	10975	*Paspalidium basicladum*			
76.	2884	*Portulaca oleracea (Purslane, Wakati)*			
77.	2704	*Ptilotus calostachyus (Weeping Mulla Mulla)*			
78.	11236	*Ptilotus gomphrenoides var. gomphrenoides*			
79.	2731	*Ptilotus helipteroides (Hairy Mulla Mulla)*			
80.	2747	*Ptilotus obovatus (Cotton Bush)*			
81.	2751	*Ptilotus polystachyus (Prince of Wales Feather)*			
82.	2754	*Ptilotus roei*			
83.	2755	*Ptilotus rotundifolius (Royal Mulla Mulla)*			
84.	15855	*Ptilotus schwartzii var. schwartzii*			
85.	7644	*Scaevola spinescens (Currant Bush, Maroon)*			
86.	12309	*Senna glutinosa subsp. pruinosa*			
87.	12308	*Senna glutinosa subsp. x luerssenii*			
88.	18445	*Senna stricta*			
89.	31759	*Sida ectogama*			
90.	4986	*Sida platycalyx (Lifesaver Burr)*			
91.	31857	*Sida sp. Golden calyces glabrous (H.N. Foote 32)*			
92.	6989	*Solanum ashbyae*			
93.	7036	*Solanum sturtianum (Thargomindah Nightshade)*			
94.	6827	*Spartothamnella teucriflora*			
95.	16199	*Stenanthemum petraeum*			
96.	3074	*Stenopetalum anfractum*			
97.	12355	*Swainsona affinis*			
98.	4220	*Swainsona canescens (Grey Swainsona)*			
99.	13595	*Swainsona elegantoides*			
100.	13339	*Synaptantha tillaeacea var. tillaeacea*			
101.	19053	*Trachymene pilbarensis*			
102.	44362	*Trianthema triquetrum*			
103.	4381	*Tribulus platypterus (Cork Hopbush)*			
104.	18072	*Tribulus suberosus*			
105.	6727	*Trichodesma zeylanicum (Camel Bush, Kumbalin)*			
106.	4316	*Trigonella suavissima (Sweet Fenugreek)*			
107.	7393	*Wahlenbergia tumidifructa*			

NatureMap
Mapping Western Australia's biodiversity

Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Table A1.1: Conservation significant flora listed in the database search results

Species	EPBC Act Listing	WC Act Listing	Priority Rank	Searches
Beyeria lepidopetala	Endangered	Vulnerable		TP List
Drakaea concolor	Vulnerable	Endangered		TP List
Eucalyptus cuprea	Endangered	Critically Endangered		TP List
Hypocalymma longifolium	Vulnerable	Vulnerable		TP List
Pityrodia augustensis	Vulnerable	Vulnerable		EPBC
Calandrinia butcherensis			P1	TP List
Chamelaucium sp. Coolcalalaya (A.H. Burbidge 4233)			P1	TP List
Eremophila anomala			P1	TP List
Eremophila appressa			P1	TP List
Eremophila graciliflora			P1	TP List
Eremophila prolata			P1	TP List
Eremophila retropila			P1	TP List
Eremophila sp. Ballythunna (R. Davis 11395)			P1	TP List
Eremophila sp. Meekatharra (D.J. Edinger 4430)			P1	TP List
Eremophila warnesii			P1	TP List
Eucalyptus semota			**P1**	**WAHERB, NM**
Goodenia salmoniana			P1	TP List
Halgania gustafsenii var. Murchison (R. Meissner & B. Bayliss 743)			P1	TP List
Lepidium xylodes			P1	TP List
Rhodanthe sphaerocephala			P1	TP List
Solanum iodinum			P1	TP List
Solanum reclusum			**P1**	**WAHERB, TP List, NM**
Stenanthemum mediale			**P1**	**Maia**
Verticordia lepidophylla var. *quantula*			P1	TP List
Acacia leptospermoides subsp. *obovata*			P2	TP List
Angianthus microcephalus			P2	TP List
Calytrix harvestiana			P2	TP List
Persoonia papillosa			P2	TP List
Scholtzia sp. East Yuna (A.C. Burns 6)			P2	TP List
Scholtzia sp. Eradu (R.D. Royce 8016)			P2	TP List
Scholtzia sp. Eurardy (J.S. Beard 6886)			P2	TP List
Scholtzia sp. Murchison River (A.S. George 7908)			P2	TP List
Solanum pycnotrichum			P2	TP List
Thysanotus sp. Desert East of Newman (R.P. Hart 964)			P2	TP List
Acacia isoneura subsp. *nimia*			P3	TP List
Acacia plautella			P3	TP List
Acacia ridleyana			P3	TP List
Beyeria cinerea subsp. *cinerea*			P3	TP List

Species	EPBC Act Listing	WC Act Listing	Priority Rank	Searches
Beyeria gardneri			P3	TP List
Blackallia nudiflora			P3	TP List
Calytrix verruculosa			P3	TP List
Eremophila lanata			P3	TP List
Eremophila obliquisepala			**P3**	**WAHERB, TP List, NM, Maia**
Eremophila rigida			P3	TP List
Eremophila shonae subsp. *diffusa*			P3	TP List
Goodenia sericostachya			P3	TP List
Hemigenia saligna			P3	TP List
Hemigenia virescens			P3	TP List
Hibiscus krichauffianus			P3	TP List
Homalocalyx echinulatus			**P3**	**Maia**
Indigofera gilesii			**P3**	**TP List, Maia**
Lasiopetalum oppositifolium			P3	TP List
Maireana prosthecochaeta			**P3**	**WAHERB, TP List, NM, Maia**
Menkea draboides			P3	TP List
Mirbelia corallina			P3	TP List
Owenia acidula			P3	TP List
Ptilotus crosslandii			P3	TP List
Ptilotus lazaridis			P3	TP List
Ptilotus luteolus			P3	TP List
***Sauropus* sp. Woolgorong (M. Officer s.n. 10/8/94)**			**P3**	**Maia**
Scaevola oldfieldii			**P3**	TP List
***Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362)**			**P3**	**Maia**
Tribulus adelacanthus			**P3**	**Maia**
Verticordia cooloomia			**P3**	TP List
Acacia speckii			P4	TP List
Eremophila pungens			P4	TP List
Goodenia berringbinensis			P4	TP List
Grevillea inconspicua			P4	TP List
Stachystemon nematophorus			P4	TP List
Triodia bromoides			P4	TP List
Wurmbea murchisoniana			P4	TP List

Note: P1 – P4 = Priority 1 to Priority 4 species; EPBC = EPBC Act Protected Matters Search Tool (DotEE, 2016c); NM = NatureMap (DPaW, 2007-); WAHERB = DPaW's Western Australian Herbarium database (search reference 22-0916FL); TP List = DPaW's Threatened and Priority Flora List (search reference 22-0916FL); Maia = Maia's database (results from previous surveys); flora species in bold font have been found within the database search area previously.

APPENDIX 2: CONSERVATION SIGNIFICANCE (FLORA AND ECOLOGICAL COMMUNITIES)

Table A2.1: Criteria for listing threatened species (DotEE, 2016d) – EPBC Act

Criteria for listing species in the critically endangered, endangered or vulnerable categories			
Criterion	**Critically Endangered**	**Endangered**	**Vulnerable**
1. It has undergone, is suspected to have undergone or is likely to undergo in the immediate future:	a very severe reduction in numbers	a severe reduction in numbers	a substantial reduction in numbers
2. Its geographic distribution is precarious for the survival of the species and is:	very restricted	restricted	limited
3. The estimated total number of individuals is:	very low	low	limited
And either of (a) or (b) is true:			
a) Evidence suggests that the number will continue to decline at: **b) The number is likely to continue to decline and its geographic distribution is:**	A very high rate Precarious for its survival	A high rate Precarious for its survival	A substantial rate Precarious for its survival
4. The estimated total number of mature individuals is:	extremely low	very low	low
5. The probability of its extinction in the wild is at least:	50% in the immediate future	20% in the near future	10% in the medium-term future

Eligibility for listing species in the extinct, extinct in the wild, or conservation dependent categories	
Category	**Definition**
Extinct*	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.
Extinct in the wild	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 only known to survive in cultivation, in captivity or as a naturalized 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.
Conservation dependent*	A native species is eligible to be included in the conservation dependent category 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.
*Note: Species listed as 'conservation dependent' and 'extinct' are not matters of national environmental significance and therefore do not trigger the EPBC Act.	

Table A2.2: Categories and definitions for threatened (declared rare) flora and fauna (DPaW, 2015) – WC Act

Code	Definition
T	**Threatened species** Published as Specially Protected under the *Wildlife Conservation Act 1950*, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora). **Threatened fauna** is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the Wildlife Conservation Act. **Threatened flora** is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the Wildlife Conservation Act. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.
CR	**Critically endangered species** Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
EN	**Endangered species** Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
VU	**Vulnerable species** Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
EX	**Presumed extinct species** Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.
IA	**Migratory birds protected under an international agreement** Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.
CD	**Conservation dependent fauna** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice.
OS	**Other specially protected fauna** Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Table A2.3: Categories and definitions for priority species (DPaW, 2015)

Code	Definition
P	**Priority species** Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or 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 or fauna. 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 or other specially protected fauna lists for other than taxonomic reasons, 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.
1	**Priority One: Poorly-known species** 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.
2	**Priority Two: Poorly-known species** 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.
3	**Priority Three: Poorly-known species** 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.
4	**Priority Four: Rare, Near Threatened and other species in need of monitoring** (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. (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. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
*Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any intraspecific category i.e. subspecies or variety, or a distinct population).	

Table A2.4: Criteria for listing threatened ecological communities (TECs) under the EPBC Act (Austlii, 2016)

Criteria for listing species in the critically endangered, endangered or vulnerable categories				
Item	**Criterion**	**Category**		
		Critically Endangered	**Endangered**	**Vulnerable**
1	Its decline in geographic distribution is:	Very severe	severe	substantial
2	Its geographic distribution is: and the nature of its distribution makes it likely that the action of a threatening process could cause it to be lost in:	Very restricted The immediate future	Restricted The near future	Limited The medium-term future
3	For a population of a native species that is likely to play a major role in the community, there is a: to the extent that restoration of the community is not likely to be possible in:	Very severe decline The immediate future	Severe decline The near future	Substantial decline The medium-term future
4	The reduction in its integrity across most of its geographic distribution is: As indicated by degradation of the community or its habitat, or distruption of important community processes that is:	Very severe Very severe	Severe severe	Substantial substantial
5	Its rate of continuing detrimental change is: As indicated by: a) A rate of continuing decline in its geographic distribution, or a population of a native species that is believed to play a major role in the community, that is: Or b) Intensification, across most of its geographic distribution, in degradation, or disruption of important community processes, that is:	Very severe Very severe Very severe	Severe Severe Severe	Substantial Substantial Serious
6	A quantitative analysis shows that its probability of extinction, or extreme degradation over all of its geographic distribution is:	At least 50% in the immediate future	At least 20% in the near future	At least 10% in the medium-term future

Table A2.5: Categories, definitions and criteria for threatened ecological communities (TECs) (DEC, 2013)

Category	Definition and Criteria
Presumed Totally Destroyed (PD)	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B): A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats; or B) All occurrences recorded within the last 50 years have since been destroyed.
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more** of the following criteria (A, B or C): A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% **and either or both** of the following apply (i or ii): (i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); (ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.
Critically Endangered (CR)	B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii): (i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); (ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; (iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B, or C): A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): (i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); (ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

Category	Definition and Criteria
Endangered (EN)	B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii): (i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); (ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; (iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B or C): A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Table A2.6: Categories, definitions and criteria for priority ecological communities (PECs) (DEC, 2013)

Category	Definition and Criteria
Priority One: Poorly-known ecological communities	Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Category	Definition and Criteria
Priority Two: Poorly-known ecological communities	Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority Three: Poorly-known ecological communities	(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) Communities made up of large, and/or widespread occurrences that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened or that have been recently removed from the threatened list. These communities require regular monitoring.	(a) Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands. (b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority Five: Conservation Dependent ecological communities	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX 3: DECLARED PESTS CATEGORIES AND CONTROLS

Table A3.1: Control categories for declared pests (DAFWA, 2016c)

Category (C)	Definition
C1 (Exclusion)	Organisms which should be excluded from part or all of Western Australia.
C2 (Eradication)	Organisms which should be eradicated from part or all of Western Australia.
C3 (Management)	Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
Unassigned	Unassigned: Declared pests that are recognised as having a harmful impact under certain circumstances, where their subsequent control requirements are determined by a Plan or other legislative arrangements under the Act.

APPENDIX 4: RELEVÉ SITE INFORMATION

Table A4.1: Information collected at relevé sites

Relevé:	R01	Described by:	Scott Hitchcock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	627071	m E	7206273	m N	
Habitat:		Sandplain					
Soil:		Red-orange sandy-loam loose soil (90%), surface crust (10%)					
Rocks:		None					
Mapped as:		*A***WL**-1					
Vegetation Type:		Open Tall Shrubland of *Acacia incurvaneura* with a Sparse Mid Shrubland of *Eremophila forrestii* subsp. *forrestii* and a Sparse Tussock Grassland of *Eragrostis eriopoda* and *Monachather paradoxa*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		Grazing					
Fire Age:		None evident					
Species:		*Acacia incurvaneura, Calandrinia polyandra, Chthonocephalus viscosus, Dysphania rhadinostachya* subsp. *rhadinostachya*, *Enchylaena tomentosa* var. *tomentosa*, *Eragrostis eriopoda, Eremophila forrestii* subsp. *forrestii*, *Eriachne* sp., *Monachather paradoxus, Ptilotus schwartzii*					
Relevé:	**R02**	**Described by:**	**Scott Hitchcock & Rochelle Haycock**		**Date:**	**2/10/2016**	**Photograph**
Location (GDA94):		MGA50	627355	m E	7206135	m N	
Habitat:		Wide drainage line with multiple channels					
Soil:		Red-orange sandy-clay surface crust (95%)					
Rocks:		Quartz gravel (5%)					
Mapped as:		*A***WL**-1					
Vegetation Type:		Open Low Forest of *Acacia citrinoviridis*, *Acacia ayersiana* and *Acacia pteraneura* with Isolated Mid Shrubs of *Eremophila forrestii* subsp. *forrestii* and Isolated Low Shrubs of *Eremophila forrestii* subsp. *forrestii*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Abutilon cryptopetalum, Acacia ayersiana, Acacia citrinoviridis, Acacia cyperophylla* var. *cyperophylla*, *Acacia pruinocarpa, Acacia pteraneura,* ***Bidens bipinnata*, Cenchrus ciliaris****, Digitaria brownii, Dodonaea petiolaris, Duperreya commixta, Enchylaena tomentosa* var. *tomentosa*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila latrobei* subsp. *latrobei*, *Evolvulus alsinoides* var. *villosicalyx*, *Grevillea berryana, Harnieria kempeana* subsp. *muelleri*, *Indigofera monophylla, Lobelia heterophylla, Ptilotus obovatus, Rhodanthe charsleyae, Sida* sp. verrucose glands (F.H. Mollemans 2423), *Solanum lasiophyllum, Wahlenbergia tumidifructa*					

Relevé:	R03	Described by:	Rochelle Haycock		Date:	4/10/2016	Photograph
Location (GDA94):		MGA50	627823	m E	7204566	m N	
Habitat:		Ironstone and quartzite stony hill (gentle footslope)					
Soil:		Red-orange sandy-clay surface crust (5%)					
Rocks:		Ironstone (75%), quartz (20%)					
Mapped as:		*A***SL**-2					
Vegetation Type:		Sparse Tall Shrubland of *Acacia rhodophloia* with Isolated Low Shrubs of *Ptilotus schwartzii* and *Eremophila jucunda* subsp. *jucunda*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		Tracks and pit bund adjacent					
Fire Age:		None evident					
Species:		*Acacia rhodophloia, Aristida contorta, Eremophila jucunda* subsp. *jucunda*, *Euphorbia tannensis* subsp. *eremophila*, *Goodenia tenuiloba, Ptilotus schwartzii, Senna glaucifolia, Sida* sp. dark green fruits (S. van Leeuwen 2260), *Sida* sp. Golden calyces glabrous (H.N. Foote 32), *Solanum lasiophyllum*					

Relevé:	R04	Described by:	Scott Hitchcock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	627521	m E	7205272	m N	
Habitat:		Creek					
Soil:		Red-orange sandy-loam loose soil (20%)					
Rocks:		Ironstone stones (10%), quartz stones (10%)					
Mapped as:		*A***WL**-1					
Vegetation Type:		Open Mid Shrubland of *Eremophila forrestii* subsp. *forrestii* with Isolated Low Trees of *Acacia pruinocarpa*, *Acacia incurvaneura* and Isolated Low Shrubs of *Enchylaena tomentosa* var. *tomentosa*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia aptaneura, Acacia ayersiana, Acacia incurvaneura, Acacia pruinocarpa, Acacia ramulosa* var. *linophylla*, *Acacia tetragonophylla, Dysphania rhadinostachya* subsp. *rhadinostachya*, *Enchylaena tomentosa* var. *tomentosa*, *Eragrostis eriopoda, Eremophila forrestii* subsp. *forrestii*, *Eremophila glutinosa, Eremophila latrobei* subsp. *latrobei*, *Indigofera monophylla, Maireana georgei, Psydrax latifolia, Senna artemisioides* subsp. *helmsii*, *Sida* sp. dark green fruits (S. van Leeuwen 2260)					

Relevé:	R05	Described by:	Rochelle Haycock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	627013	m E	7205627	m N	
Habitat:		Quartz stony hill (gentle midslope)					
Soil:		Red-orange sandy-clay surface crust (10%)					
Rocks:		Quartz stones (60%), gravel (30%)					
Mapped as:		*A***SL**-2					
Vegetation Type:		Sparse Low Shrubland of *Eremophila jucunda* subsp. *jucunda* with Sparse Tussock Grassland of *Eriachne mucronata* with Isolated Low Trees of Grevillea *berryana* other and Isolated Tall Shrubs of *Acacia incurvaneura* and *Acacia citrinoviridis*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia citrinoviridis,* ***Acacia cockertoniana*** **(RE),** *Acacia incurvaneura, Aristida contorta, Eremophila jucunda* subsp. *jucunda*, ***Eremophila obliquisepala*** **(P3),** *Eriachne mucronata, Eriachne pulchella* subsp. *dominii*, *Euphorbia tannensis* subsp. *eremophila*, *Grevillea berryana, Ptilotus obovatus, Ptilotus schwartzii, Sida* sp. dark green fruits (S. van Leeuwen 2260), *Sida* sp. Golden calyces glabrous (H.N. Foote 32), *Solanum lasiophyllum, Thysanotus exiliflorus*					

Relevé:	R06	Described by:	Rochelle Haycock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	626914	m E	7205094	m N	
Habitat:		Quartz stony hill (gentle footslope)					
Soil:		Red-orange sandy-clay surface crust (10%)					
Rocks:		Quartz stones (60%), gravel (30%)					
Mapped as:		*A***SL**-4					
Vegetation Type:		Sparse mixed Chenopod Shrubland (*Maireana suaedifolia*, *Sclerolaena eriacantha* and *Sclerolaena lanicuspis*) with Isolated Tall Shrubs of *Acacia xiphophylla* and Isolated Mid Shrubs of *Senna* sp. Meekatharra (E. Bailey 1-26)					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia aptaneura, Acacia tetragonophylla, Acacia xiphophylla, Hibiscus burtonii, Maireana georgei, Maireana suaedifolia, Rhagodia eremaea, Rhyncharrhena linearis, Sclerolaena eriacantha, Sclerolaena eurotioides, Sclerolaena lanicuspis, Senna artemisioides* subsp. *oligophylla* x *helmsii*, *Solanum lasiophyllum*					

Relevé:	R07	Described by:	Rochelle Haycock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	626958	m E	7204885	m N	
Habitat:		Small drainage line (gentle footslope)					
Soil:		Red-orange sandy-clay loose soil (70%)					
Rocks:		Quartz stones (10%), gravel (20%)					
Mapped as:		*A***SL**-4					
Vegetation Type:		Open Mid Shrubland of *Scaevola spinescens* and *Senna* sp. Meekatharra (E. Bailey 1-26) with Open Low Woodland of *Acacia aptaneura* and Sparse Tall Shrubland of *Acacia cuthbertsonii* subsp. *cuthbertsonii* and *Acacia aptaneura*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia aptaneura, Acacia cuthbertsonii* subsp. *cuthbertsonii*, *Acacia incurvaneura, Acacia xiphophylla, Eragrostis eriopoda, Eremophila glutinosa, Eremophila latrobei* subsp. *latrobei*, *Hibiscus* sp. Gardneri (A.L. Payne PRP 1435), *Lepidium platypetalum, Maireana suaedifolia, Psydrax latifolia, Ptilotus nobilis, Ptilotus obovatus, Scaevola spinescens, Sclerolaena cuneata, Sclerolaena eriacantha, Sclerolaena lanicuspis, Senna artemisioides* subsp. *oligophylla* x *helmsii*, *Sida ectogama, Solanum lasiophyllum*					

Relevé:	R08	Described by:	Scott Hitchcock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	627504	m E	7204566	m N	
Habitat:		Hill gentle (upperslope)					
Soil:		Red-orange sandy-loam loose soil (5%)					
Rocks:		Ironstone surface plates (60%), stones (30%), gravel (5%)					
Mapped as:		*A***SL**-3					
Vegetation Type:		Sparse Low Shrubland of *Eremophila latrobei* subsp. *latrobei*, *Dodonaea pachyneura* with Isolated Mallee Trees of *Corymbia ferriticola* (5m) and Isolated Tall Shrubs of *Acacia aptaneura*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia aptaneura,* ***Acacia cockertoniana*** **(RE),** *Aristida contorta, Corymbia ferriticola, Dodonaea pachyneura, Eremophila exilifolia, Eremophila latrobei* subsp. *latrobei*, *Eriachne mucronata, Psydrax suaveolens, Ptilotus obovatus, Ptilotus schwartzii, Sida* sp. Excedentifolia (J.L. Egan 1925)					

Relevé:	R09	Described by:	Scott Hitchcock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	627219	m E	7204596	m N	
Habitat:		Hill gentle (lower slope)					
Soil:		Red-orange sandy-loam loose soil (10%)					
Rocks:		Ironstone boulders (10%), stones (60%), quartz stones (20%)					
Mapped as:		*A***SL**-1					
Vegetation Type:		Sparse Mid Shrubland of *Eremophila phyllopoda*, *Senna glutinosa* subsp. *pruinosa* with Isolated Tall Trees of *Acacia aptaneura*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia aptaneura, Acacia incurvaneura, Acacia tetragonophylla, Aristida contorta, Eragrostis eriopoda, Eremophila exilifolia, Eremophila forrestii* subsp. *forrestii*, *Eremophila jucunda* subsp. *jucunda*, *Eremophila phyllopoda, Maireana georgei,* ***Maireana polypterygia*** **(RE),** *Scaevola spinescens, Senna glutinosa* subsp. *pruinosa*, *Sida* sp. dark green fruits (S. van Leeuwen 2260), *Solanum lasiophyllum*					

Relevé:	R10	Described by:	Rochelle Haycock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	626982	m E	7204298	m N	
Habitat:		Quartz stony hill (gentle foot slope)					
Soil:		Red-orange sandy-clay surface crust (20%)					
Rocks:		Quartz stones (50%), gravel (20%), ironstone gravel (10%)					
Mapped as:		M**SL**-1					
Vegetation Type:		Sparse Tussock Grassland of *Aristida contorta* with Isolated Tall Shrubs of *Acacia pteraneura* and Isolated Low Shrubs of *Ptilotus rotundifolius*, *Eremophila phyllopoda* and *Senna glaucifolia*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia pteraneura, Aristida contorta, Calandrinia creethiae, Calocephalus beardii, Dysphania rhadinostachya* subsp. *rhadinostachya*, *Eremophila phyllopoda, Goodenia tenuiloba, Portulaca cyclophylla, Psydrax latifolia, Ptilotus rotundifolius, Senna artemisioides* subsp. *helmsii*, *Senna glaucifolia, Stenopetalum anfractum, Thysanotus exiliflorus*					

Relevé:	R11	Described by:	Rochelle Haycock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	627010	m E	7204007	m N	
Habitat:		Quartz and ironstone stony undulating plain					
Soil:		Red-orange sandy-clay surface crust (20%)					
Rocks:		Quartz (30%), ironstone (50%)					
Mapped as:		M**SL**-1					
Vegetation Type:		Open Tussock Grassland of *Aristida contorta* with a Sparse Mid Shrubland of *Eremophila phyllopoda* with Isolated Tall Shrubs of *Acacia pteraneura* and Isolated Low Shrubs of *Senna glutinosa* subsp. *pruinosa* and *Solanum lasiophyllum*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia pteraneura, Aristida contorta, Calocephalus beardii,* ***Eremophila obliquisepala*** **(P3),** *Eremophila phyllopoda, Goodenia tenuiloba, Maireana georgei, Senna glaucifolia, Senna glutinosa* subsp. *pruinosa*, *Solanum lasiophyllum, Trianthema* sp.					

Relevé:	R12	Described by:	Rochelle Haycock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	627301	m E	7203067	m N	
Habitat:		Wide drainage line with multiple channels					
Soil:		Red-orange sandy-clay surface crust (30%), loose soil (40%)					
Rocks:		Quartz stones (15%), gravel (15%)					
Mapped as:		*A***WL**-1					
Vegetation Type:		Open Low Forest of *Acacia aptaneura* and *Acacia cyperophylla* var. *cyperophylla* with Sparse Tussock Grassland of *Aristida contorta* and *Chrysopogon fallax* with Isolated Tall Shrubs of *Acacia cuthbertsonii* subsp. *cuthbertsonii* with Isolated Mid Shrubs of *Senna glaucifolia* and *Senna artemisioides* subsp. *helmsii* and Isolated Low Shrubs of *Indigofera monophylla*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Abutilon cryptopetalum, Acacia aptaneura, Acacia craspedocarpa* x *macraneura*, *Acacia cuthbertsonii* subsp. *cuthbertsonii*, *Acacia cyperophylla* var. *cyperophylla*, ***Acacia quadrimarginea*** **(RE),** *Aristida contorta,* ***Cenchrus ciliaris*,*** *Chrysopogon fallax, Eremophila exilifolia, Eremophila forrestii* subsp. *forrestii*, *Eremophila phyllopoda, Eriachne pulchella* subsp. *dominii*, *Erodium cygnorum, Evolvulus alsinoides* var. *villosicalyx*, *Goodenia tenuiloba, Hakea lorea* subsp. *lorea*, *Hibiscus* sp. Gardneri (A.L. Payne PRP 1435), *Indigofera monophylla, Phyllanthus erwinii, Ptilotus obovatus, Senna artemisioides* subsp. *helmsii*, *Senna glaucifolia, Sida* sp. verrucose glands (F.H. Mollemans 2423), *Solanum lasiophyllum, Trachymene pilbarensis*					

Relevé:	R13	Described by:	Scott Hitchcock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	627847	m E	7202953	m N	
Habitat:		Hill very gentle (hillslope)					
Soil:		Red-orange sandy-loam loose soil (20%)					
Rocks:		Dolerite surface plates (60%), gravel (20%)					
Mapped as:		*A***SL**-2					
Vegetation Type:		Sparse Tall Shrubland of *Acacia quadrimarginea*, *Acacia rhodophloia* with a Sparse Mid Shrubland of *Senna glutinosa* subsp. *pruinosa* with Sparse Low Shrubland of *Senna glutinosa* subsp. *pruinosa*, *Eremophila exilifolia*, *Indigofera fractiflexa* subsp. *fractiflexa* and Isolated Tussock Grasses of *Aristida contorta*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia incurvaneura,* ***Acacia quadrimarginea*** **(RE),** *Acacia rhodophloia, Aristida contorta, Dysphania rhadinostachya* subsp. *rhadinostachya*, *Eremophila exilifolia, Eremophila latrobei* subsp. *latrobei*, ***Indigofera fractiflexa*** **subsp.** ***fractiflexa*** **(RE),** *Ptilotus obovatus, Ptilotus rotundifolius, Senna glaucifolia, Senna glutinosa* subsp. *pruinosa*, *Sida* sp. dark green fruits (S. van Leeuwen 2260), *Sida* sp. Excedentifolia (J.L. Egan 1925), *Solanum lasiophyllum, Tribulus suberosus*					

Relevé:	R14	Described by:	Scott Hitchcock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	628739	m E	7203248	m N	
Habitat:		Hill very gentle					
Soil:		Red-orange sandy-loam loose soil (20%)					
Rocks:		Quartz stones (20%), boulders (40%), ironstone shale (20%)					
Mapped as:		*A***SL**-3					
Vegetation Type:		Sparse Tall Shrubland of *Acacia incurvaneura* with Sparse Low Shrubland of *Eremophila jucunda* subsp. *jucunda* and Isolated Low Trees of *Acacia pruinocarpa*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia incurvaneura, Acacia pruinocarpa, Acacia tetragonophylla, Aristida contorta, Dodonaea pachyneura, Eremophila glutinosa, Eremophila jucunda* subsp. *jucunda*, *Eremophila latrobei* subsp. *latrobei*, *Hibiscus* sp. Gardneri (A.L. Payne PRP 1435), *Ptilotus obovatus, Ptilotus schwartzii, Sarcostemma viminale, Senna artemisioides* subsp. *oligophylla* x *helmsii*, *Sida* sp. dark green fruits (S. van Leeuwen 2260)					

Relevé:	R15	Described by:	Rochelle Haycock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	629353	m E	7202833	m N	
Habitat:		Quartz stony undulating plain					
Soil:		Red-orange sandy-clay surface crust (20%)					
Rocks:		Quartz stones (60%), ironstone gravel (20%)					
Mapped as:		*A***SL**-4					
Vegetation Type:		Sparse Tall Shrubland of *Acacia aptaneura* with Sparse Low Shrubland of *Ptilotus schwartzii*, *Eremophila jucunda* subsp. *jucunda* and ***Eremophila obliquisepala*** **(P3)**					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia aptaneura, Acacia pruinocarpa, Aristida contorta, Eremophila exilifolia, Eremophila jucunda* subsp. *jucunda*, ***Eremophila obliquisepala*** **(P3),** *Maireana georgei, Maireana suaedifolia, Maireana villosa, Ptilotus rotundifolius, Ptilotus schwartzii, Rhyncharrhena linearis, Sclerolaena eriacantha, Sclerolaena eurotioides, Sida* sp. dark green fruits (S. van Leeuwen 2260), *Solanum lasiophyllum*					

Relevé:	R16	Described by:	Rochelle Haycock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	629967	m E	7202549	m N	
Habitat:		Quartz stony undulating plain					
Soil:		Red-orange sandy-clay surface crust (30%)					
Rocks:		Quartz stones (50%), gravel (20%)					
Mapped as:		*A***SL**-2					
Vegetation Type:		Sparse Low Shrubland of *Eremophila jucunda* subsp. *jucunda* and *Ptilotus schwartzii* with Isolated Low Trees of *Acacia pruinocarpa* and Isolated Tall Shrubs of *Acacia pteraneura*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia pruinocarpa, Acacia pteraneura, Aristida contorta, Eremophila jucunda* subsp. *jucunda*, ***Eremophila obliquisepala*** **(P3),** *Goodenia tenuiloba, Grevillea berryana,* ***Maireana polypterygia*** **(RE),** *Ptilotus schwartzii, Rhyncharrhena linearis, Thysanotus exiliflorus*					

Relevé:	R17	Described by:	Rochelle Haycock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	630414	m E	7202080	m N	
Habitat:		Quartz stony undulating plain					
Soil:		Red-orange sandy-clay surface crust (10%)					
Rocks:		Quartz stones (70%), gravel (20%)					
Mapped as:		*A***SL**-2					
Vegetation Type:		Sparse Low Shrubland of *Eremophila exilifolia*, *Eremophila jucunda* subsp. *jucunda* and *Ptilotus schwartzii* with Isolated Tall Shrubs of *Acacia incurvaneura*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia incurvaneura, Aristida contorta, Eremophila exilifolia, Eremophila jucunda* subsp. *jucunda*, *Goodenia tenuiloba, Ptilotus schwartzii, Senna stricta*					
Relevé:	**R18**	**Described by:**	**Rochelle Haycock**		**Date:**	**2/10/2016**	**Photograph**
Location (GDA94):		MGA50	630126	m E	7201825	m N	
Habitat:		Quartz and ironstone stony plain					
Soil:		Red-orange sandy-clay surface crust (30%)					
Rocks:		Quartz stones (40%), ironstone gravel (30%)					
Mapped as:		*A***SL**-2					
Vegetation Type:		Sparse Tall Shrubland of *Acacia incurvaneura* and *Acacia pteraneura*with a Sparse Mid Shrubland of *Senna glutinosa* subsp. *pruinosa* and Sparse Low Shrubland of *Eremophila phyllopoda*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Abutilon cryptopetalum, Acacia citrinoviridis, Acacia incurvaneura, Acacia pteraneura, Aristida contorta, Eremophila jucunda* subsp. *jucunda*, *Eremophila phyllopoda, Eriachne pulchella* subsp. *dominii*, *Ptilotus obovatus, Rhyncharrhena linearis, Senna glutinosa* subsp. *pruinosa*, *Solanum lasiophyllum, Zygophyllum iodocarpum*					

Relevé:	R19	Described by:	Rochelle Haycock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	629270	m E	7201825	m N	
Habitat:		Wide drainage line with multiple channels					
Soil:		Red-orange clayey-sand loose soil (70%)					
Rocks:		Quartz gravel (20%), stones (10%)					
Mapped as:		*A***WL**-1					
Vegetation Type:		Tussock Grassland of Mixed grasses (*Aristida contorta*, *Eriachne pulchella* subsp. *dominii* and *Chrysopogon fallax*) with Open Tall Shrubland of *Acacia aptaneura* and *Acacia incurvaneura* with a Sparse Mid Shrubland of *Grevillea deflexa* and *Acacia rhodophloia* and Sparse Low Shrubland of *Grevillea deflexa*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Abutilon cryptopetalum, Acacia aptaneura, Acacia citrinoviridis, Acacia cuthbertsonii* subsp. *cuthbertsonii*, *Acacia fuscaneura, Acacia incurvaneura, Acacia ramulosa* var. *linophylla*, *Acacia rhodophloia, Aristida contorta, Aristida holathera,* ***Bidens bipinnata*,*** *Calytrix desolata, Cheilanthes sieberi* subsp. *sieberi*, *Chrysopogon fallax, Eragrostis cumingii, Eremophila forrestii* subsp. *forrestii*, *Eremophila glutinosa, Eriachne aristidea, Eriachne pulchella* subsp. *dominii*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena kanisii, Goodenia tenuiloba, Grevillea deflexa, Hakea lorea* subsp. *lorea*, *Hibiscus* sp. Gardneri (A.L. Payne PRP 1435), *Indigofera monophylla, Mirbelia rhagodioides, Phyllanthus erwinii, Psydrax rigidula, Rhyncharrhena linearis, Sida* sp. dark green fruits (S. van Leeuwen 2260), *Sida* sp. verrucose glands (F.H. Mollemans 2423), *Stenopetalum* sp., *Synaptantha tillaeacea* var. *tillaeacea*, *Thysanotus manglesianus, Trachymene pilbarensis, Wahlenbergia tumidifructa*					

Relevé:	R21	Described by:	Rochelle Haycock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	628593	m E	7200748	m N	
Habitat:		Quartz stony plain					
Soil:		Red-orange sandy-clay surface crust (98%)					
Rocks:		Quartz stones (2%)					
Mapped as:		*A***SL**-1					
Vegetation Type:		Tall Shrubland of *Acacia ayersiana* and *Acacia aptaneura* with Isolated Mid Shrubs of *Acacia cockertoniana* and Isolated Low Shrubs of *Eremophila latrobei* subsp. *latrobei*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Abutilon cryptopetalum, Acacia aptaneura, Acacia ayersiana,* ***Acacia cockertoniana*** **(RE),** *Acacia ramulosa* var. *linophylla*, *Aristida contorta, Cheilanthes sieberi* subsp. *sieberi*, *Duperreya commixta, Eremophila latrobei* subsp. *latrobei*, *Hibiscus burtonii, Psydrax latifolia, Psydrax rigidula, Ptilotus obovatus, Ptilotus schwartzii, Senna glaucifolia, Sida* sp. dark green fruits (S. van Leeuwen 2260), *Sida* sp. Golden calyces glabrous (H.N. Foote 32)					

Relevé:	R22	Described by:	Rochelle Haycock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	629468	m E	7201105	m N	
Habitat:		Quartz stony undulating plain					
Soil:		Red-orange sandy-clay surface crust (20%)					
Rocks:		Quartz stones (50%), gravel (30%)					
Mapped as:		*A***SL**-2					
Vegetation Type:		Sparse Tall Shrubland of *Acacia incurvaneura* and *Acacia citrinoviridis* with Sparse Low Shrubland of *Eremophila jucunda* subsp. *jucunda*, ***Eremophila obliquisepala*** **(P3)** and *Ptilotus obovatus*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia citrinoviridis, Acacia incurvaneura, Aristida contorta, Eremophila jucunda* subsp. *jucunda*, *Eremophila latrobei* subsp. *latrobei*, ***Eremophila obliquisepala*** **(P3),** *Goodenia tenuiloba, Grevillea berryana, Ptilotus obovatus, Ptilotus schwartzii, Sida* sp. dark green fruits (S. van Leeuwen 2260)					

Relevé:	R36	Described by:	Scott Hitchcock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	628507	m E	7202609	m N	
Habitat:		Undulating plain					
Soil:		Red-orange sandy-loam loose soil (40%), surface crust (10%)					
Rocks:		Granite stones (30%), quartz stones (30%)					
Mapped as:		*A***SL**-2					
Vegetation Type:		Sparse Tussock Grassland of *Aristida contorta* with Isolated Tall Shrubs of *Acacia incurvaneura*, *Acacia citrinoviridis*, *Grevillea berryana* and Isolated Low Shrubs of ***Eremophila obliquisepala*** **(P3)**, *Eremophila jucunda* subsp. *jucunda*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		Vehicle tracks					
Fire Age:		None evident					
Species:		*Acacia citrinoviridis,* ***Acacia cockertoniana*** **(RE),** *Acacia incurvaneura, Aristida contorta, Calandrinia creethiae, Calocephalus multiflorus, Eremophila jucunda* subsp. *jucunda*, *Eremophila latrobei* subsp. *latrobei*, ***Eremophila obliquisepala*** **(P3),** *Grevillea berryana, Monachather paradoxus, Psydrax latifolia, Ptilotus schwartzii, Senna glaucifolia, Solanum lasiophyllum,* ***Tribulus hirsutus*** **(RE)**					

Relevé:	R37	Described by:	Scott Hitchcock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	627093	m E	7201730	m N	
Habitat:		Undulating plain very gentle					
Soil:		Red-orange sandy-loam surface crust (10%), loose soil (10%)					
Rocks:		Quartz stones (40%), gravel (20%), ironstone stones (20%)					
Mapped as:		*A***SL**-1					
Vegetation Type:		Isolated Tall Shrubs of *Acacia incurvaneura* and *Acacia aptaneura* with Isolated Low Shrubs of *Eremophila spathulata*, *Senna stricta* and Isolated Chenopod Shrubs of *Maireana georgei* and *Sclerolaena eriacantha*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia aptaneura, Acacia citrinoviridis, Acacia incurvaneura, Acacia pruinocarpa, Acacia tetragonophylla, Aristida contorta, Eremophila spathulata, Goodenia tenuiloba,* ***Gunniopsis propinqua*** **(P3),** *Lepidium platypetalum, Maireana georgei,* ***Maireana polypterygia*** **(RE),** *Ptilotus roei, Ptilotus schwartzii, Scaevola spinescens, Sclerolaena eriacantha, Senna* sp. Meekatharra (E. Bailey 1-26), *Senna stricta*					

Relevé:	R38	Described by:	Scott Hitchcock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	628015	m E	7201749	m N	
Habitat:		Hill gentle (upperslope)					
Soil:		Red-orange loam surface crust (5%), loose soil (5%)					
Rocks:		Granite boulders (30%), ironstone boulders (30%), ironstone gravel (30%)					
Mapped as:		*A***SL**-3					
Vegetation Type:		Open Low Shrubland of *Eremophila jucunda* subsp. *jucunda*, *Eremophila latrobei* subsp. *latrobei* with Sparse Tall Shrubland of *Acacia incurvaneura* and Isolated Tussock Grasses of *Eragrostis eriopoda*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia incurvaneura, Aristida contorta, Corymbia ferriticola, Eragrostis eriopoda, Eremophila exilifolia, Eremophila glutinosa, Eremophila jucunda* subsp. *jucunda*, *Eremophila latrobei* subsp. *latrobei*, *Eriachne mucronata, Eriachne pulchella* subsp. *pulchella*, *Ptilotus schwartzii, Sida* sp. Excedentifolia (J.L. Egan 1925), *Thysanotus manglesianus*					

Relevé:	R39	Described by:	Rochelle Haycock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	628719	m E	7201293	m N	
Habitat:		Quartz stony undulating plain					
Soil:		Red-orange sandy-clay surface crust (40%)					
Rocks:		Quartz stones (40%), gravel (20%)					
Mapped as:		*A***SL**-2					
Vegetation Type:		Sparse Low Shrubland of *Eremophila exilifolia*, *Ptilotus schwartzii* and *Eremophila jucunda* subsp. *jucunda* with Sparse Tussock Grassland of *Aristida contorta* and Isolated Tall Shrubs of *Grevillea berryana* and *Acacia incurvaneura*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia incurvaneura, Acacia tetragonophylla, Aristida contorta, Eremophila exilifolia, Eremophila jucunda* subsp. *jucunda, Euphorbia boophthona, Goodenia tenuiloba, Grevillea berryana, Psydrax latifolia, Psydrax rigidula, Ptilotus roei, Ptilotus schwartzii*					

Relevé:	R40	Described by:	Scott Hitchcock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	628164	m E	7205043	m N	
Habitat:		Range moderate (ridgetop)					
Soil:		Red-orange sandy-loam loose soil (10%)					
Rocks:		Ironstone surface plates (70%), stones (20%)					
Mapped as:		*A***SL**-3					
Vegetation Type:		Sparse Low Shrubland of *Ptilotus obovatus*, *Dodonaea pachyneura*, *Eremophila jucunda* subsp. *jucunda* with Sparse Tussock Grassland of *Eriachne mucronata* and Isolated Tall Shrubs of *Acacia aptaneura*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		Site adjacent to existing pit					
Fire Age:		None evident					
Species:		*Acacia aptaneura, Acacia ramulosa* var. *ramulosa*, *Dodonaea pachyneura, Eremophila jucunda* subsp. *jucunda*, *Eremophila punctata, Eriachne mucronata, Grevillea berryana, Ptilotus obovatus, Ptilotus schwartzii, Sida* sp. Excedentifolia (J.L. Egan 1925)					

Relevé:	R41	Described by:	Scott Hitchcock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	628175	m E	7204454	m N	
Habitat:		Hill gentle (upperslope)					
Soil:		Red-orange sandy-loam loose soil (10%)					
Rocks:		Ironstone boulders (10%), stones (60%), gravel (20%)					
Mapped as:		*A***SL**-3					
Vegetation Type:		Sparse Tall Shrubland of *Acacia incurvaneura* with a Sparse Low Shrubland of *Eremophila exilifolia*, *Dodonaea pachyneura* and Isolated Forbs of *Sida* sp. Excedentifolia (J.L. Egan 1925)					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia incurvaneura, Aristida contorta, Cheilanthes lasiophylla, Dodonaea pachyneura, Eremophila exilifolia, Eremophila glutinosa, Eremophila jucunda* subsp. *jucunda*, *Eremophila latrobei* subsp. *latrobei*, *Eriachne mucronata, Grevillea berryana, Ptilotus schwartzii, Sida* sp. Excedentifolia (J.L. Egan 1925)					

Relevé:	R42	Described by:	Scott Hitchcock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	628171	m E	7204108	m N	
Habitat:		Minor channel gentle (bed)					
Soil:		Red-orange sandy-loam loose soil (20%)					
Rocks:		Ironstone boulders (50%), ironstone stones (10%), quartz stones (20%)					
Mapped as:		*A***SL**-5					
Vegetation Type:		Tall Shrubland of *Acacia rhodophloia* with Open Low Shrubland of *Harnieria kempeana* subsp. *muelleri*, *Hibiscus sturtii* var. *forrestii* and Isolated Low Trees of *Acacia aptaneura*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia aptaneura, Acacia citrinoviridis, Acacia cuthbertsonii* subsp. *cuthbertsonii*, *Acacia rhodophloia, Dodonaea pachyneura, Dodonaea petiolaris,* ***Enneapogon lindleyanus*** **(RE),** *Eremophila exilifolia, Eremophila glutinosa, Eremophila latrobei* subsp. *latrobei*, *Eriachne mucronata, Goodenia tenuiloba, Grevillea berryana, Grevillea deflexa, Harnieria kempeana* subsp. *muelleri*, *Hibiscus* sp. Gardneri (A.L. Payne PRP 1435), *Hibiscus sturtii* var. *forrestii*, *Psydrax latifolia, Ptilotus obovatus, Santalum spicatum, Sida ectogama, Sida* sp. Excedentifolia (J.L. Egan 1925)					

Relevé:	R43	Described by:	Scott Hitchcock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	628179	m E	7203819	m N	
Habitat:		Range moderate (upperslope)					
Soil:		Red-orange sandy-loam loose soil (10%)					
Rocks:		Ironstone surface plates (60%), stones (30%)					
Mapped as:		*A***SL**-3					
Vegetation Type:		Open Low Shrubland of *Ptilotus obovatus*, *Eremophila latrobei* subsp. *latrobei* with Sparse Tall Shrubland of *Acacia rhodophloia*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia aptaneura, Acacia rhodophloia, Aristida contorta, Dodonaea pachyneura, Eremophila latrobei* subsp. *latrobei*, *Eriachne mucronata, Eriachne pulchella* subsp. *dominii*, *Hibiscus burtonii, Monachather paradoxus, Ptilotus obovatus, Senna glaucifolia, Sida* sp. Excedentifolia (J.L. Egan 1925)					

Relevé:	R44	Described by:	Scott Hitchcock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	628247	m E	7203587	m N	
Habitat:		Hill very gentle (hilltop)					
Soil:		Red-orange sandy-loam surface crust (5%)					
Rocks:		Ironstone surface plates (60%), stones (35%)					
Mapped as:		*A***SL**-3					
Vegetation Type:		Sparse Tall Shrubland of *Acacia incurvaneura* with Sparse Low Shrubland of *Ptilotus obovatus* and Isolated Mid Shrubs of *Eremophila latrobei* subsp. *latrobei*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		Vehicle tracks					
Fire Age:		None evident					
Species:		*Acacia incurvaneura, Acacia rhodophloia, Aristida contorta, Dodonaea pachyneura, Eremophila jucunda* subsp. *jucunda*, *Eremophila latrobei* subsp. *latrobei*, *Eriachne mucronata, Ptilotus obovatus, Ptilotus schwartzii, Sida* sp. Golden calyces glabrous (H.N. Foote 32)					

Relevé:	R45	Described by:	Rochelle Haycock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	627365	m E	7203722	m N	
Habitat:		Quartz stony undulating plain					
Soil:		Red-orange sandy-clay surface crust (30%)					
Rocks:		Quartz stones (40%), gravel (25%), ironstone stones (5%)					
Mapped as:		*A***SL**-1					
Vegetation Type:		Open Tussock Grassland of *Aristida contorta* with Sparse Tall Shrubland of *Acacia incurvaneura* and *Acacia aptaneura* with Sparse Mid Shrubland of *Eremophila phyllopoda* and *Senna glaucifolia* and Isolated Low Shrubs of *Ptilotus obovatus* and *Ptilotus schwartzii*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia aptaneura, Acacia incurvaneura, Acacia pruinocarpa, Acacia tetragonophylla, Aristida contorta, Cheilanthes sieberi* subsp. *sieberi*, *Eremophila phyllopoda, Goodenia tenuiloba, Ptilotus nobilis, Ptilotus obovatus, Ptilotus roei, Ptilotus schwartzii, Rhyncharrhena linearis*					

Relevé:	R46	Described by:	Scott Hitchcock		Date:	1/10/2016	Photograph
Location (GDA94):		MGA50	627634	m E	7204285	m N	
Habitat:		Low rolling hill very gentle (lowerslope)					
Soil:		Red-orange sandy-loam loose soil (30%)					
Rocks:		Quartz stones (20%), ironstone gravel (50%)					
Mapped as:		*A***SL**-5					
Vegetation Type:		Sparse Tall Shrubland of *Acacia incurvaneura*, *Acacia cuthbertsonii* subsp. *cuthbertsonii* with a Sparse Tussock Grassland of *Aristida contorta* and Isolated Mid Shrubs of *Senna glaucifolia*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia cuthbertsonii* subsp. *cuthbertsonii*, *Acacia incurvaneura, Aristida contorta, Duperreya commixta, Eremophila exilifolia, Eremophila glutinosa, Eremophila jucunda* subsp. *jucunda*, *Eremophila latrobei* subsp. *latrobei*, *Euphorbia boophthona, Ptilotus schwartzii, Senna glaucifolia, Sida* sp. dark green fruits (S. van Leeuwen 2260), *Solanum lasiophyllum*					

Relevé:	R47	Described by:	Rochelle Haycock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	628070	m E	7203352	m N	
Habitat:		Quartz stony hill (gentle footslope)					
Soil:		Red-orange sandy-clay surface crust (10%)					
Rocks:		Quartz stones (50%), gravel (40%)					
Mapped as:		M**SL**-1					
Vegetation Type:		Sparse Low Shrubland of *Senna artemisioides* subsp. *helmsii*, *Senna glaucifolia* and *Ptilotus rotundifolius* with Sparse Tussock Grassland of *Aristida contorta* and Isolated Mid Shrubs of *Acacia rhodophloia* and *Acacia incurvaneura*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia cuthbertsonii* subsp. *cuthbertsonii*, *Acacia incurvaneura, Acacia rhodophloia, Aristida contorta, Calocephalus beardii, Goodenia tenuiloba, Maireana georgei, Ptilotus roei, Ptilotus rotundifolius, Ptilotus schwartzii, Senna artemisioides* subsp. *helmsii*, *Senna glaucifolia, Sida* sp. dark green fruits (S. van Leeuwen 2260), *Solanum lasiophyllum*					

Relevé:	R48	Described by:	Rochelle Haycock		Date:	3/10/2016	Photograph
Location (GDA94):		MGA50	627363	m E	7203468	m N	
Habitat:		Quartz and ironstone stony undulating plain					
Soil:		Red-orange sandy-clay surface crust (10%)					
Rocks:		Quartz (30%), ironstone					
Mapped as:		M**SL**-1					
Vegetation Type:		Open Low Woodland of *Acacia aptaneura* with Sparse Mid Shrubland of *Eremophila phyllopoda* and Sparse Tussock Grassland of *Aristida contorta*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia aptaneura, Acacia cuthbertsonii* subsp. *cuthbertsonii*, *Aristida contorta, Calocephalus beardii,* ***Eremophila obliquisepala* (P3),** *Eremophila phyllopoda, Goodenia tenuiloba, Psydrax latifolia, Ptilotus rotundifolius, Senna glaucifolia, Senna glutinosa* subsp. *pruinosa*, *Sida* sp. dark green fruits (S. van Leeuwen 2260), *Solanum lasiophyllum*					

Relevé:	R49	Described by:	Scott Hitchcock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	627294	m E	7202630	m N	
Habitat:		Stony plain					
Soil:		Red-orange sandy-loam loose soil (40%)					
Rocks:		Quartz stones (40%), ironstone stones (20%)					
Mapped as:		M**SL**-1					
Vegetation Type:		Sparse Tussock Grassland of *Aristida contorta* with Isolated Tall Shrubs of *Acacia incurvaneura*, *Acacia aptaneura* and Isolated Low Shrubs of *Eremophila phyllopoda* and *Eremophila exilifolia*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia aptaneura, Acacia cuthbertsonii* subsp. *cuthbertsonii*, *Acacia incurvaneura, Acacia tetragonophylla, Aristida contorta, Calocephalus beardii, Eremophila exilifolia, Eremophila latrobei* subsp. *latrobei*, ***Eremophila obliquisepala* (P3),** *Eremophila phyllopoda, Euphorbia boophthona, Goodenia tenuiloba, Ptilotus obovatus, Ptilotus roei, Ptilotus rotundifolius, Senna artemisioides* subsp. *helmsii*, *Senna glutinosa* subsp. x *luerssenii*, ***Senna* sp. Austin (A. Strid 20210) (RE),** *Sida* sp. dark green fruits (S. van Leeuwen 2260), *Solanum lasiophyllum*					

Relevé:	R58	Described by:	Scott Hitchcock		Date:	4/10/2016	Photograph
Location (GDA94):		MGA50	627938	m E	7204653	m N	No photograph available
Habitat:		Minor channel gentle (bed)					
Soil:		Red-orange sandy-loam loose soil (20%)					
Rocks:		Ironstone boulders (50%), ironstone stones (10%), quartz stones (20%)					
Mapped as:		*A***SL**-5					
Vegetation Type:		Open Tall Shrubland of *Acacia incurvaneura* with Open Low Shrubland of *Dodonaea pachyneura* and *Eremophila glutinosa* Sparse Tussock Grassland of *Eriachne mucronata*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia citrinoviridis, Acacia cuthbertsonii* subsp. *cuthbertsonii*, *Acacia incurvaneura, Acacia rhodophloia, Dodonaea pachyneura, Dodonaea petiolaris,* ***Enneapogon lindleyanus* (RE),** *Eremophila exilifolia, Eremophila glutinosa, Eremophila latrobei* subsp. *latrobei*, *Eriachne mucronata, Goodenia tenuiloba, Grevillea berryana, Grevillea deflexa, Harnieria kempeana* subsp. *muelleri*, *Hibiscus* sp. Gardneri (A.L. Payne PRP 1435), *Hibiscus sturtii* var. *forrestii*, *Psydrax latifolia, Ptilotus obovatus, Santalum spicatum, Sida ectogama, Sida* sp. Excedentifolia (J.L. Egan 1925), ***Stenanthemum mediale* (P1, RE)**					

Relevé:	RR01	Described by:	Rochelle Haycock		Date:	2/10/2016	Photograph
Location (GDA94):		MGA50	630036	m E	7201859	m N	
Habitat:		Quartz and ironstone stony undulating plain					
Soil:		Red-orange sandy-clay surface crust (30%)					
Rocks:		Quartz stones (50%), ironstone gravel (20%)					
Mapped as:		*A***SL**-4					
Vegetation Type:		Open Chenopod Shrubland of *Tecticornia disarticulata*, *Sclerolaena cuneata* and *Sclerolaena eriacantha* with Isolated Tall Shrubs of *Acacia xiphophylla*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia xiphophylla, Enchylaena tomentosa* var. *tomentosa*, *Maireana suaedifolia, Maireana villosa, Ptilotus nobilis, Salsola australis, Sclerolaena cuneata, Sclerolaena eriacantha, Senna artemisioides* subsp. *oligophylla* x *helmsii*, *Tecticornia disarticulata, Zygophyllum iodocarpum*					
Relevé:	**SHR3**	**Described by:**	**Scott Hitchcock**		**Date:**	**3/10/2016**	**Photograph**
Location (GDA94):		MGA50	628240	m E	7205155	m N	
Habitat:		Hill gentle (midslope)					
Soil:		Red-orange sandy-loam loose soil (10%)					
Rocks:		Ironstone surface plates (60%), shale (30%)					
Mapped as:		*A***SL**-2					
Vegetation Type:		Sparse Mid Shrubland of *Senna glutinosa* subsp. *pruinosa*, *Senna stricta* with Isolated Tall Shrubs of *Acacia incurvaneura*					
Vegetation Condition:		2 (Pristine or nearly so)					
Disturbances:		None					
Fire Age:		None evident					
Species:		*Acacia cuthbertsonii* subsp. *cuthbertsonii*, *Acacia incurvaneura, Acacia tetragonophylla, Eremophila exilifolia, Eremophila jucunda* subsp. *jucunda*, ***Eremophila obliquisepala* (P3),** *Grevillea berryana, Psydrax latifolia, Ptilotus rotundifolius, Ptilotus schwartzii, Senna glutinosa* subsp. *pruinosa*, *Senna stricta, Sida* sp. dark green fruits (S. van Leeuwen 2260), *Solanum lasiophyllum*					

Note: m E = metres East, m N = metres North, * = environmental weed, P1 = Priority One species, P3 = Priority Three species, RE = range extension, forma = form, sp. = species, subsp. = subspecies, var. = variety, x = crossed with.

Table A4.2: Relevé site coordinates (GDA94, MGA50)

Site	Easting (mE)	Northing (mN)
R01	627071	7206273
R02	627355	7206135
R03	627823	7204566
R04	627521	7205272
R05	627013	7205627
R06	626914	7205094
R07	626958	7204885
R08	627504	7204566
R09	627219	7204596
R10	626982	7204298
R11	627010	7204007
R12	627301	7203067
R13	627847	7202953
R14	628739	7203248
R15	629353	7202833
R16	629967	7202549
R17	630414	7202080
R18	630126	7201825
R19	629270	7201825
R21	628593	7200748
R22	629468	7201105
R36	628507	7202609
R37	627093	7201730
R38	628015	7201749
R39	628719	7201293
R40	628164	7205043
R41	628175	7204454
R42	628171	7204108
R43	628179	7203819
R44	628247	7203587
R45	627365	7203722
R46	627634	7204285
R47	628070	7203352
R48	627363	7203468
R49	627294	7202630
R58	627938	7204653
RR01	630036	7201859
SHR3	628240	7205155

Note: mE = metres east/easting, mN = metres north/northing

APPENDIX 5: NATIONAL VEGETATION INFORMATION SYSTEM VEGETATION CLASSIFICATION

Table A5.1: NVIS growth forms and descriptions

Growth Form	Description
Tree	Woody plants, more than 2m tall with a single stem or branches well above the base.
Tree Mallee	Woody perennial plant usually of the genus *Eucalyptus*. Multi-stemmed with fewer than 5 trunks of which at least 3 exceed 100 mm at breast height (1.3 m). Usually 8 m or more in height.
Shrub	Woody plants multi-stemmed at the base (or within 200 mm from ground level) or if single stemmed, less than 2 m in height.
Mallee Shrub	Commonly less than 8 m tall, usually with 5 or more trunks, of which at least 3 of the largest do not exceed 100 mm at breast height (1.3 m).
Heath Shrub	Shrub usually less than 2 m, with sclerophyllous leaves having high fibre: protein ratios and with an area of nanophyll or smaller (less than 225 sq. m.). Often a member of the following families: Epacridaceae, Myrtaceae, Fabaceae and Proteaceae. Commonly occur in nutrient-poor substrates.
Chenopod Shrub	Single or multi-stemmed, semi-succulent shrub of the family Chenopodiaceae exhibiting drought and salt tolerance.
Samphire Shrub	Genera (of Tribe Salicornioideae, viz: *Halosarcia*, *Pachycornia, Sarcocornia*, *Sclerostegia*, *Tecticornia* and *Tegicornia*) with articulate branches, fleshy stems and reduced flowers within the Chenopodiaceae family, succulent chenopods. Also genus *Suaeda*.
Tussock Grass	Forms discrete but open tussocks usually with distinct individual shoots, or if not, then forming a hummock. These are common agricultural grasses.
Hummock Grass	Coarse xeromorphic grass with a mound-like form often dead in the middle; genera are *Triodia* and *Plectrachne*.
Sedge	Herbaceous, usually perennial erect plant generally with a tufted habit and of the families Cyperaceae (true sedges) or Restionaceae (node sedges).
Rush	Herbaceous, usually perennial erect monocot that is neither a grass nor sedge. For the purposes of NVIS, rushes include the monocotyledon families Juncaceae, Typhaceae, Liliaceae, Iridaceae, Xyridaceae and the genus *Lomandra* (i.e. "graminoid" or grass-like genera).
Forb	Herbaceous or slightly woody, annual or sometimes perennial plant (usually a dicotyledon).
Grass-tree	Australian grass trees. Members of the family Xanthorrhoeaceae.
Cycad	Members of the families Cycadaceae and Zamiaceae.

Table A5.2: Height classes defined for the NVIS

Height Classes	Height Range (m)	Tree	Shrub, Heath Shrub, Chenopod Shrub, Samphire Shrub, Cycad, Grass-tree	Tree Mallee, Mallee Shrub	Tussock Grasses, Sedges, Rushes and Forbs
8	**>30**	tall			
7	**10-30**	mid		tall	
6	**<10**	low		mid	
5	**<3**			low	

Height Classes	Height Range (m)	Tree	Shrub, Heath Shrub, Chenopod Shrub, Samphire Shrub, Cycad, Grass-tree	Tree Mallee, Mallee Shrub	Tussock Grasses, Sedges, Rushes and Forbs
4	**>2**		tall		tall
3	**1-2**		mid		tall
2	**0.5-1**		low		mid
1	**<0.5**		low		low

Table A5.3: NVIS structural formation terminology

Growth Form	Height (m)	Foliage Cover (%)					
		>70	**30-70**	**10-30**	**2-10**	**<2 (isolated)**	**<2 (isolated clump)**
Tree	**<10,10-30, >30**	Closed Forest	Open Forest	Woodland	Open Woodland	Isolated Trees	Isolated Clumps Of Trees
Tree Mallee	**<3, <10, 10-30**	Closed Mallee Forest	Open Mallee Forest	Mallee Woodland	Open Mallee Woodland	Isolated Mallee Trees	Isolated Clumps Of Mallee Trees
Shrub	**<1,1-2,>2**	Closed Shrubland	Shrubland	Open Shrubland	Sparse Shrubland	Isolated Shrubs	Isolated Clumps Of Shrubs
Mallee Shrub	**<3, <10, 10-30**	Closed Mallee Shrubland	Mallee Shrubland	Open Mallee Shrubland	Sparse Mallee Shrubland	Isolated Mallee Shrubs	Isolated Clumps Of Mallee Shrubs
Heath Shrub	**<1,1-2,>2**	Closed Heathland	Heathland	Open Heathland	Sparse Heathland	Isolated Heath Shrubs	Isolated Clumps Of Heath Shrubs
Chenopod Shrub	**<1,1-2,>2**	Closed Chenopod Shrubland	Chenopod Shrubland	Open Chenopod Shrubland	Sparse Chenopod Shrubland	Isolated Chenopod Shrubs	Isolated Clumps Of Chenopod Shrubs
Samphire Shrub	**<0.5,>0.5**	Closed Samphire Shrubland	Samphire Shrubland	Open Samphire Shrubland	Sparse Samphire Shrubland	Isolated Samphire Shrubs	Isolated Clumps Of Samphire Shrubs
Hummock Grass	**<2,>2**	Closed Hummock Grassland	Hummock Grassland	Open Hummock Grassland	Sparse Hummock Grassland	Isolated Hummock Grasses	Isolated Clumps Of Hummock Grasses
Tussock Grass	**<0.5,>0.5**	Closed Tussock Grassland	Tussock Grassland	Open Tussock Grassland	Sparse Tussock Grassland	Isolated Tussock Grasses	Isolated Clumps Of Tussock Grasses
Sedge	**<0.5,>0.5**	Closed Sedgeland	Sedgeland	Open Sedgeland	Sparse Sedgeland	Isolated Sedges	Isolated Clumps Of Sedges
Rush	**<0.5,>0.5**	Closed Rushland	Rushland	Open Rushland	Sparse Rushland	Isolated Rushes	Isolated Clumps Of Rushes
Forb	**<0.5,>0.5**	Closed Forbland	Forbland	Open Forbland	Sparse Forbland	Isolated Forbs	Isolated Clumps Of Forbs

Source: **Tables A2.1 to A2.3** from ESCAVI (2003).

APPENDIX 6: VASCULAR FLORA SPECIES LIST

Table A6.1: Vascular flora species list

Family	Taxa	Relevé	OppColl	FlFr
Acanthaceae	*Harnieria kempeana* subsp. *muelleri*	•		Fl
Aizoaceae	***Gunniopsis propinqua* (P3)**	•	•	Fr
Aizoaceae	*Trianthema* sp. indet.	•		Fr
Amaranthaceae	*Gomphrena kanisii*	•		Fl
Amaranthaceae	*Ptilotus helipteroides*		•	Fl
Amaranthaceae	*Ptilotus nobilis*	•	•	Fl
Amaranthaceae	*Ptilotus obovatus*	•	•	Fl
Amaranthaceae	*Ptilotus roei*	•	•	Fl
Amaranthaceae	*Ptilotus rotundifolius*	•	•	Fl
Amaranthaceae	*Ptilotus schwartzii*	•	•	Fl
Apocynaceae	*Rhyncharrhena linearis*	•	•	Fr
Apocynaceae	*Sarcostemma viminale*	•	•	
Araliaceae	*Trachymene pilbarensis*	•	•	FlFr
Asparagaceae	*Thysanotus exiliflorus*	•	•	Fl
Asparagaceae	*Thysanotus manglesianus*	•		Fl
Asteraceae	***Bidens bipinnata****	•		Fr
Asteraceae	*Calocephalus beardii*	•	•	Fl
Asteraceae	*Calocephalus multiflorus*	•		FlFr
Asteraceae	*Calotis hispidula*		•	Fr
Asteraceae	*Centipeda thespidioides*		•	FlFr
Asteraceae	*Chthonocephalus viscosus*	•	•	Fl
Asteraceae	*Helipterum craspedioides*		•	Fl
Asteraceae	***Ixiochlamys cuneifolia* (RE)**		•	Fl
Asteraceae	***Myriocephalus appendiculatus* (RE)**		•	Fl
Asteraceae	*Myriocephalus oldfieldii*		•	Fl
Asteraceae	*Podolepis aristata* subsp. *affinis*		•	Fl
Asteraceae	*Rhodanthe charsleyae*	•	•	FlFr
Asteraceae	*Rhodanthe propinqua*		•	FlFr
Asteraceae	***Senecio hamersleyensis* (RE)**		•	Fr
Boraginaceae	*Heliotropium heteranthum*		•	Fl
Boraginaceae	***Trichodesma zeylanicum* var. *zeylanicum* (RE)**		•	Fl
Brassicaceae	*Lepidium platypetalum*	•	•	FlFr
Brassicaceae	*Stenopetalum anfractum*	•	•	Fr
Brassicaceae	*Stenopetalum* sp. indet.	•	•	FlFr
Campanulaceae	*Lobelia heterophylla*	•	•	Fl
Campanulaceae	*Wahlenbergia tumidifructa*	•	•	FlFr
Celastraceae	*Stackhousia muricata*		•	Fl
Chenopodiaceae	*Dysphania melanocarpa* forma *melanocarpa*		•	Fr
Chenopodiaceae	*Dysphania rhadinostachya* subsp. *rhadinostachya*	•	•	FlFr
Chenopodiaceae	*Enchylaena tomentosa* var. *tomentosa*	•		Fr
Chenopodiaceae	*Maireana georgei*	•	•	FlFr
Chenopodiaceae	***Maireana polypterygia* (RE)**	•	•	Fr

Family	Taxa	Relevé	OppColl	FlFr
Chenopodiaceae	*Maireana suaedifolia*	•	•	FlFr
Chenopodiaceae	*Maireana villosa*	•	•	Fr
Chenopodiaceae	*Rhagodia eremaea*	•	•	Fl
Chenopodiaceae	*Salsola australis*	•	•	Fr
Chenopodiaceae	*Sclerolaena bicornis*		•	Fr
Chenopodiaceae	*Sclerolaena cuneata*	•	•	Fr
Chenopodiaceae	*Sclerolaena eriacantha*	•	•	Fr
Chenopodiaceae	*Sclerolaena eurotioides*	•	•	Fr
Chenopodiaceae	*Sclerolaena lanicuspis*	•		Fr
Chenopodiaceae	*Tecticornia disarticulata*	•	•	
Convolvulaceae	*Duperreya commixta*	•		Fr
Convolvulaceae	*Evolvulus alsinoides* var. *villosicalyx*	•	•	FlFr
Euphorbiaceae	*Euphorbia australis* var. ?*subtomentosa*		•	Fr
Euphorbiaceae	*Euphorbia boophthona*	•	•	FlFr
Euphorbiaceae	*Euphorbia tannensis* subsp. *eremophila*	•	•	Fr
Fabaceae	*Acacia aptaneura*	•	•	Fr
Fabaceae	*Acacia ayersiana*	•		Fr
Fabaceae	*Acacia citrinoviridis*	•	•	Fr
Fabaceae	***Acacia cockertoniana* (RE)**	•	•	Fl
Fabaceae	*Acacia craspedocarpa*		•	Fr
Fabaceae	*Acacia craspedocarpa* x *macraneura*	•	•	Fr
Fabaceae	*Acacia cuthbertsonii* subsp. *cuthbertsonii*	•	•	Fr
Fabaceae	*Acacia cyperophylla* var. *cyperophylla*	•		Fr
Fabaceae	*Acacia fuscaneura*	•		Fr
Fabaceae	*Acacia incurvaneura*	•	•	Fr
Fabaceae	*Acacia kempeana*		•	Fr
Fabaceae	*Acacia macraneura* hybrid		•	Fr
Fabaceae	*Acacia pruinocarpa*	•	•	
Fabaceae	*Acacia pteraneura*	•		
Fabaceae	***Acacia quadrimarginea* (RE)**	•	•	
Fabaceae	*Acacia ramulosa* var. *linophylla*	•	•	Fr
Fabaceae	*Acacia ramulosa* var. *ramulosa*	•		Fr
Fabaceae	*Acacia rhodophloia*	•	•	Fr
Fabaceae	*Acacia tetragonophylla*	•	•	Fr
Fabaceae	*Acacia wanyu*		•	
Fabaceae	*Acacia xiphophylla*	•		Fr
Fabaceae	***Indigofera fractiflexa* subsp. *fractiflexa* (RE)**	•	•	Fr
Fabaceae	***Indigofera gilesii* (P3) (RE)**		•	Fr
Fabaceae	***Indigofera ?gilesii* (Potential P3)**			
Fabaceae	*Indigofera monophylla*	•		Fr
Fabaceae	*Isotropis forrestii*		•	Fr
Fabaceae	*Mirbelia rhagodioides*	•	•	FlFr
Fabaceae	*Senna artemisioides* subsp. *helmsii*	•	•	FlFr
Fabaceae	*Senna artemisioides* subsp. *oligophylla* x *helmsii*	•		FlFr
Fabaceae	*Senna artemisioides* subsp. x *artemisioides*		•	FlFr
Fabaceae	*Senna glaucifolia*	•	•	FlFr

Family	Taxa	Relevé	OppColl	FlFr
Fabaceae	*Senna glutinosa* subsp. *pruinosa*	•	•	FlFr
Fabaceae	*Senna glutinosa* subsp. x *luerssenii*	•	•	Fl
Fabaceae	***Senna* sp. Austin (A. Strid 20210) (RE)**	•		
Fabaceae	*Senna* sp. Meekatharra (E. Bailey 1-26)	•		Fl
Fabaceae	*Senna stricta*	•	•	Fr
Geraniaceae	*Erodium cygnorum*	•	•	FlFr
Goodeniaceae	*Brunonia australis*		•	Fl
Goodeniaceae	*Goodenia tenuiloba*	•	•	FlFr
Goodeniaceae	*Scaevola spinescens*	•	•	Fl
Lamiaceae	*Spartothamnella teucriiflora*		•	FlFr
Malvaceae	*Abutilon cryptopetalum*	•	•	Fr
Malvaceae	*Hibiscus burtonii*	•		Fr
Malvaceae	*Hibiscus* sp. Gardneri (A.L. Payne PRP 1435)	•	•	Fr
Malvaceae	*Hibiscus sturtii* var. *forrestii*	•	•	FlFr
Malvaceae	***Sida brownii* (RE)**		•	Fr
Malvaceae	*Sida ectogama*	•		Fr
Malvaceae	*Sida platycalyx*		•	
Malvaceae	*Sida* sp. dark green fruits (S. van Leeuwen 2260)	•	•	FlFr
Malvaceae	*Sida* sp. Excedentifolia (J.L. Egan 1925)	•	•	FlFr
Malvaceae	*Sida* sp. Golden calyces glabrous (H.N. Foote 32)	•	•	Fl
Malvaceae	*Sida* sp. verrucose glands (F.H. Mollemans 2423)	•	•	FlFr
Myrtaceae	*Calytrix desolata*	•		Fl
Myrtaceae	*Corymbia ferriticola*	•	•	Fr
Myrtaceae	*Micromyrtus sulphurea*		•	Fl
Myrtaceae	***Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362) (P3, RE)**		•	**FlFr**
Phyllanthaceae	*Phyllanthus erwinii*	•		Fr
Poaceae	*Aristida contorta*	•	•	FlFr
Poaceae	*Aristida holathera*	•		Fr
Poaceae	***Cenchrus ciliaris****	•		Fr
Poaceae	*Chrysopogon fallax*	•	•	Fr
Poaceae	*Digitaria brownii*	•	•	FlFr
Poaceae	***Enneapogon lindleyanus* (RE)**	•	•	FlFr
Poaceae	*Eragrostis cumingii*	•	•	Fr
Poaceae	*Eragrostis eriopoda*	•	•	Fr
Poaceae	*Eriachne aristidea*	•		Fr
Poaceae	*Eriachne mucronata*	•		Fr
Poaceae	*Eriachne pulchella* subsp. *dominii*	•	•	Fr
Poaceae	*Eriachne pulchella* subsp. *pulchella*	•		
Poaceae	*Eriachne* sp. indet.	•	•	
Poaceae	*Monachather paradoxus*	•	•	Fr
Poaceae	*Triodia melvillei*		•	
Polygonaceae	***Rumex vesicarius****		•	Fr
Portulacaceae	*Calandrinia creethiae*	•	•	Fl
Portulacaceae	*Calandrinia polyandra*	•		Fl
Portulacaceae	*Calandrinia ptychosperma*		•	FlFr

Family	Taxa	Relevé	OppColl	FlFr
Portulacaceae	*Calandrinia reticulata*		•	Fl
Portulacaceae	*Calandrinia schistorhiza*		•	Fl
Portulacaceae	***Calandrinia* sp. Lumeah (R.W. Purdie 2168) (RE)**		•	FlFr
Portulacaceae	*Portulaca cyclophylla*	•		Fl
Portulacaceae	*Portulaca oleracea*		•	
Proteaceae	*Grevillea berryana*	•	•	Fr
Proteaceae	*Grevillea deflexa*	•	•	FlFr
Proteaceae	*Hakea lorea* subsp. *lorea*	•		Fl
Proteaceae	*Hakea preissii*		•	Fr
Pteridaceae	*Cheilanthes lasiophylla*	•		
Pteridaceae	*Cheilanthes sieberi* subsp. *sieberi*	•		
Rhamnaceae	***Stenanthemum mediale* (P1) (RE)**	•		Fr
Rubiaceae	*Psydrax latifolia*	•	•	
Rubiaceae	*Psydrax rigidula*	•	•	
Rubiaceae	*Psydrax suaveolens*	•	•	
Rubiaceae	*Synaptantha tillaeacea* var. *tillaeacea*	•		
Santalaceae	*Santalum spicatum*	•		
Sapindaceae	*Dodonaea pachyneura*	•	•	Fr
Sapindaceae	*Dodonaea petiolaris*	•	•	Fr
Scrophulariaceae	*Eremophila exilifolia*	•	•	FlFr
Scrophulariaceae	*Eremophila forrestii* subsp. *forrestii*	•	•	FlFr
Scrophulariaceae	*Eremophila fraseri* subsp. *fraseri*		•	FlFr
Scrophulariaceae	*Eremophila gilesii* subsp. *variabilis*		•	FlFr
Scrophulariaceae	*Eremophila glutinosa*	•	•	FlFr
Scrophulariaceae	*Eremophila jucunda* subsp. *jucunda*	•	•	FlFr
Scrophulariaceae	*Eremophila lachnocalyx*		•	Fr
Scrophulariaceae	*Eremophila latrobei* subsp. *latrobei*	•	•	Fr
Scrophulariaceae	***Eremophila obliquisepala* (P3)**	•	•	FlFr
Scrophulariaceae	*Eremophila oppositifolia* subsp. *angustifolia*		•	Fr
Scrophulariaceae	*Eremophila phyllopoda*	•	•	FlFr
Scrophulariaceae	*Eremophila punctata*	•		
Scrophulariaceae	*Eremophila spathulata*	•	•	Fr
Solanaceae	*Solanum austropiceum*		•	Fr
Solanaceae	*Solanum lasiophyllum*	•	•	FlFr
Violaceae	***Hybanthus aurantiacus* (RE)**		•	
Zygophyllaceae	***Tribulus hirsutus* (RE)**	•	•	FlFr
Zygophyllaceae	*Tribulus suberosus*	•	•	Fr
Zygophyllaceae	*Zygophyllum iodocarpum*	•	•	FlFr

Note: * = environmental weed, P1 = Priority One species, P3 = Priority Three species, ?P3 = potential Priority Three species, RE = range extension, Fl = flowering material, Fr = fruiting material, FlFr = flowering and fruiting material, forma = form, sp. = species, sp. indet. = indeterminate species, subsp. = subspecies, var. = variety, x = crossed with. Nomenclature based on current WA Herbarium terminology and confirmed on FloraBase (WAH, 1998-).