

# Northam - Pithara Road Threatened and Priority Targeted Flora Survey

SLK 129.12 to 152.25



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SLK 129.12 to 152.25

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## Quality Information

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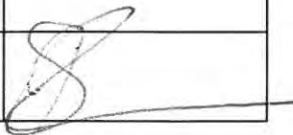
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## Table of Contents

Executive Summary		i
1.0	Introduction	1
	1.1	Background
	1.2	Location
	1.3	Scope of Work
	1.3.1	Level 2 Flora and Vegetation Survey – Realignment Section
2.0	Existing Environment	3
	2.1	Climate
	2.2	IBRA Regions
	2.3	Geology and Soils
	2.4	Flora and Vegetation
3.0	Legislative Framework	9
	3.1	Commonwealth Listed Species
	3.2	State Listed Species
4.0	Methodology	11
	4.1	Desktop Assessment
	4.2	Targeted Species Search
	4.2.1	Identification of Conservation Significant Species
	4.3	Level 2 Flora and Vegetation Survey – Realignment Section
5.0	Results	13
	5.1	Desktop Assessment
	5.2	Targeted Flora Search
	5.2.1	<i>Eremophila viscida</i>
	5.2.2	<i>Frankenia conferta</i>
	5.2.3	<i>Dampiera glabrescens</i>
	5.2.4	<i>Acacia lirellata</i> subsp. <i>compressa</i>
	5.2.5	<i>Acacia dissona</i> var. <i>indoloria</i>
	5.2.6	<i>Acacia scalena</i>
	5.2.7	<i>Podotherca uniseta</i>
	5.3	Level 2 Flora and Vegetation Survey - Realignment Section
	5.3.1	Flora
	5.3.2	Vegetation
6.0	Discussion	39
	6.1	DRF Species
	6.2	Priority Flora Species
	6.3	Realignment Section
7.0	Conclusion and Recommendations	41
8.0	References	43
Appendix A		
	Conservation significant species potentially occurring within the Project Area	A
Appendix B		
	Flora species recorded during the survey	B

### List of Plates

Plate 1	<i>Eremophila viscida</i>	19
Plate 2	<i>Frankenia conferta</i>	20
Plate 3	<i>Dampiera glabrescens</i>	22
Plate 4	<i>Acacia lirellata</i> subsp. <i>compressa</i>	26
Plate 5	<i>Acacia dissona</i> var. <i>indoloria</i>	29
Plate 6	<i>Acacia scalena</i>	31
Plate 7	<i>Podotherca uniseta</i>	33

**List of Tables**

Table 1	Soil types of the Project Area (Source: Bureau of Rural Science, 1991)	4
Table 2	Surface geology of the Project Area (Source: Geological Survey of WA and Geoscience Australia, 2008)	5
Table 3	Pre-European vegetation associations of the Project Area	7
Table 4	Conservation categories under the EPBC Act (adapted from definitions in Section 179 of the EPBC Act)	9
Table 5	Threatened flora rankings under the IUCN Red List criteria (DPaW, 2014)	10
Table 6	DPaW flora Priority rankings (abbreviated from DPaW, 2014)	10
Table 7	Species focused on during the targeted survey	16
Table 8	Populations of <i>Eremophila viscida</i>	20
Table 9	Populations of <i>Frankenia conferta</i>	21
Table 10	Populations of <i>Dampiera glabrescens</i>	23
Table 11	Populations of <i>Acacia lirellata</i> subsp. <i>compressa</i>	27
Table 12	Populations of <i>Acacia dissona</i> var. <i>indoloria</i>	29
Table 13	Populations of <i>Acacia scalena</i>	32
Table 14	Populations of <i>Pododtheca unisetata</i>	34
Table 15	Vegetation communities within the realignment section	36
Table 16	Conservation significant species potentially occurring within the Project Area	A
Table 17	Flora species recorded during the survey	B

**List of Figures**

Figure 1	Location of the Project Area	2
Figure 2	Rainfall and temperature statistics for Dalwallinu (Source BoM 2014)	3
Figure 3	Soils and surface geology of the Project Area	6
Figure 4	Pre-European vegetation associations within the Project Area	8
Figure 5	Known records of conservation significant species	14
Figure 6	Recorded populations of conservation significant species	35
Figure 7	Vegetation community and condition of the realignment section	38

## Executive Summary

The Northam Pithara Road is currently a single lane dual carriage road that services a number of small towns located along its length. The northern end of the road connects to Great Northern Highway. The Northam Pithara Road requires upgrading to provide better sightlines and realignment of two substandard bends. To enable the road to comply with safety standards, Main Roads Western Australia (Main Roads) plans to upgrade the Northam Pithara Road between SLK 129.12 to 152.25 through widening and resealing the road alignment and realigning several sections.

The purpose of the survey is to identify and map populations of Threatened (DRF) and Priority Flora within the Project Area to determine if they will be impacted by the project. The results of the targeted survey will assist in the preparation of a Clearing Impact Assessment (CIA) and Vegetation Management Plan (VMP) and may be used for road design refinement if required.

A targeted survey identified seven DRF and Priority Flora species:

- *Eremophila viscida* – DRF
- *Frankenia conferta* – DRF
- *Dampiera glabrescens* – Priority 1
- *Acacia lirellata* subsp. *compressa* – Priority 2
- *Acacia dissona* var. *indoloria* – Priority 3
- *Acacia scalene* – Priority 3
- *Podotrochea unisetata* – Priority 3

Road realignment is required for two sections containing substandard curves, from SLK 136.82 to 139.57 and SLK 140.27 to 141.33. A single phase Level 2 survey of flora and vegetation was conducted within the realignment section. A total of four vegetation communities were mapped, one of which was aligned to Priority Ecological Community (PEC) 20 – Eucalypt Woodlands of the Western Australian Wheatbelt. A total of 51 flora species were recorded, three of which were DRF and Priority Flora species and four were weeds.

General recommendations included to minimise clearing of the road side vegetation as a number of Priority Flora Species, *Dampiera glabrescens*, *Acacia lirellata* subsp. *compressa*, *Acacia dissona* var. *indoloria* and *Acacia scalene* favour road verge habitats. It is also recommended that Main Roads minimise clearing to the PEC within the realignment section.

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## 1.0 Introduction

### 1.1 Background

Main Roads Western Australia (Main Roads) is proposing to upgrade the Northam Pithara Road between SLK 129.12 and SLK 152.25 (the Project Area) in order to comply with required road safety standards. The upgrade works will involve:

- realignment of two sections containing substandard curves, from SLK 136.82 to 139.57 and SLK 140.27 to 141.33 (realignment section)
- upgrading one section to provide clear zone distance away from the above groundwater main situated on the western side of the existing road verge, between SLK 128.96 to 131.28
- upgrading of the existing 4-way intersection of Federation Road and Ballidu-Bindi Bindi Road, located between SLK 128.96 to 131.28
- widening and sealing the entire length 15m each side of the existing centre line, between SLK 129.12 to SLK 152.25.

A biological assessment was undertaken for this project in 2012 (AECOM, 2012). The assessment recommended a targeted Threatened (DRF) and Priority Flora survey be undertaken for the project during spring. The results of the targeted survey will assist in the preparation of a Clearing Impact Assessment (CIA) and Vegetation Management Plan (VMP) and may be used for road design refinement if required.

### 1.2 Location

The Project Area is located along the Northam Pithara Road between SLK 129.12 and SLK 152.25, and is approximately 23.13km in length. The Project Area is approximately 180 km north-east of Perth within two shires; the Shire of Dalwallinu to the north and the Shire of Wongan-Ballidu to the south. More locally the Project Area is situated between the towns of Pithara to the north and Ballidu to the south (Figure 1). At its northern end the Project Area extends north along Great Northern Highway for approximately 4.5 km.

### 1.3 Scope of Work

The purpose of the survey was to identify and map populations of Threatened (DRF) and Priority Flora within the Project Area to determine if they will be impacted by the project. The outcome of the survey will be used in the environmental assessment and approvals process.

The scope of work included:

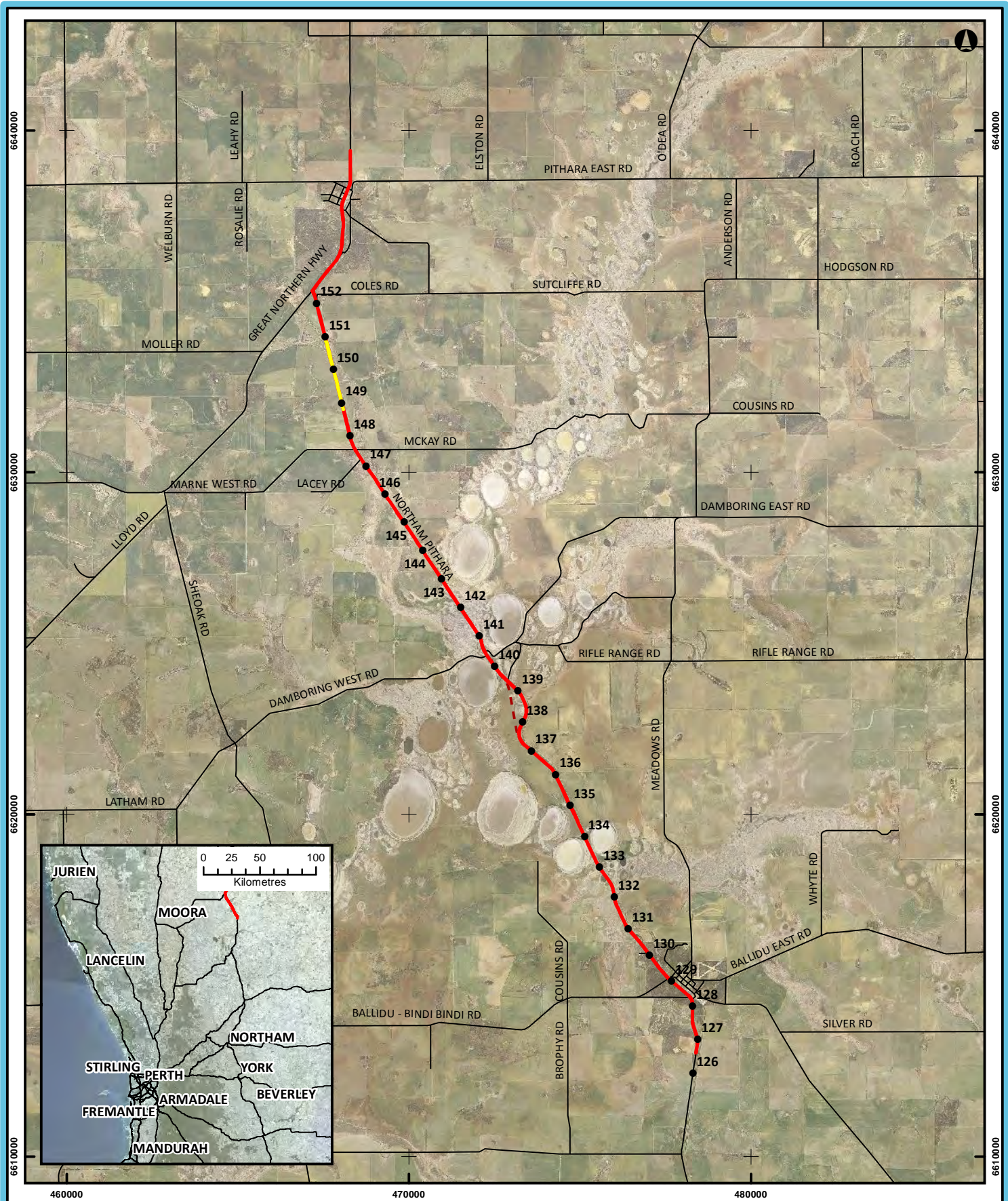
- identifying and mapping populations of DRF and Priority Flora within the Project Area
- identifying and mapping populations of DRF and Priority Flora that will be impacted by clearing based on available project design
- counting the number of individuals within each population of DRF and Priority Flora
- conducting a Level 2 flora and vegetation assessment of the realignment section.

Significant populations that extended outside the Project Area were also surveyed, where possible.

#### 1.3.1 Level 2 Flora and Vegetation Survey – Realignment Section

The vegetation communities of the Project Area have been previously mapped during the 2012 biological assessment (AECOM, 2012). The existing vegetation mapping for the Project Area does not cover the proposed realignment section, therefore a Level 2 flora and vegetation survey for the realignment section is required.



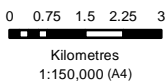


### Project Location

Northam-Pithara Rd DRF

Figure 1

Coordinate System: GDA 1994 MGA Zone 50



### LEGEND

- Project Area
- Priority Area
- Proposed Road Realignment

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## 2.0 Existing Environment

### 2.1 Climate

The climate of the region is described as semi-arid (dry) warm Mediterranean (Beecham, 2001). The nearest Australian Government Bureau of Meteorology (BoM) recording site is at Dalwallinu. This BoM site has recorded an average annual rainfall of 287.1 mm since 1997 predominantly occurring from May to September (Figure 2), coinciding with the lowest average temperatures (Figure 2) (BoM, 2014). Dalwallinu rainfall data for 2014 is illustrated in Figure 2 compared with the average rainfall for the site. Although August rainfall in the region was lower than the mean, the three weeks preceding the targeted survey in September experienced higher than average rainfall.

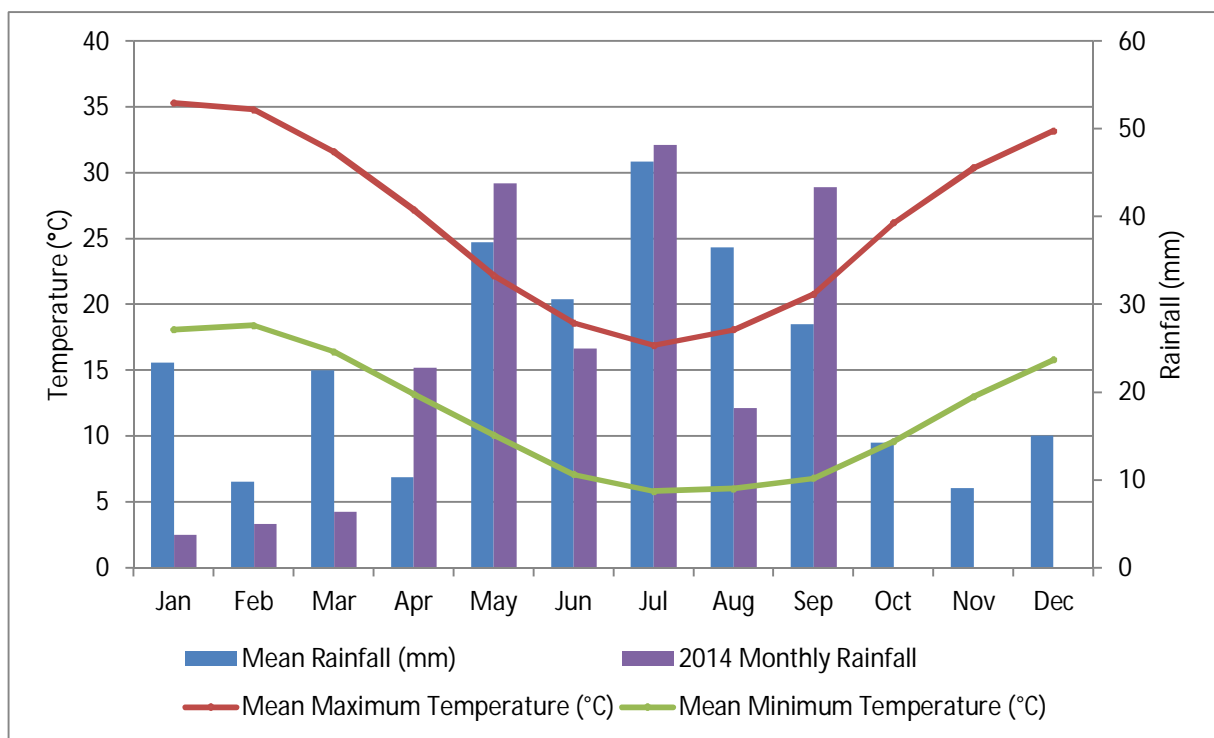


Figure 2 Rainfall and temperature statistics for Dalwallinu (Source BoM 2014)

### 2.2 IBRA Regions

There are 89 recognised Interim Biogeographic Regionalisation for Australia (IBRA) regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (Commonwealth of Australia, 2013). Western Australia supports 53 IBRA subregions and the survey area lies within the Avon Wheatbelt IBRA region, and within the Avon Wheatbelt 1 Ancient Drainage Subregion.

The Avon Wheatbelt 1 subregion is described as a gently undulating landscape of low relief (Beecham, 2001). Major vegetation types include Proteaceous scrub-heaths, rich in endemics on residual lateritic uplands and derived sandplains; mixed eucalypt, *Allocasuarina huegeliana* and Jam-York Gum woodland on Quaternary alluvials and eluvials (Beecham, 2001). Salt lake chains occur as remnants of ancient drainage systems that now only function in very wet years (Beecham, 2001).

## 2.3 Geology and Soils

Beard (1990) describes the topography and soils of the wheatbelt region as:

“Undulating plateau, mostly with disorganised drainage. Remnants of prior land surface are preserved, giving rise to catenary sequences of soils, typically yellow earths on sandplain with ironstone gravels peripheral to same, hard-setting loam soils on slopes and bottomlands and saline soils in depressions.”

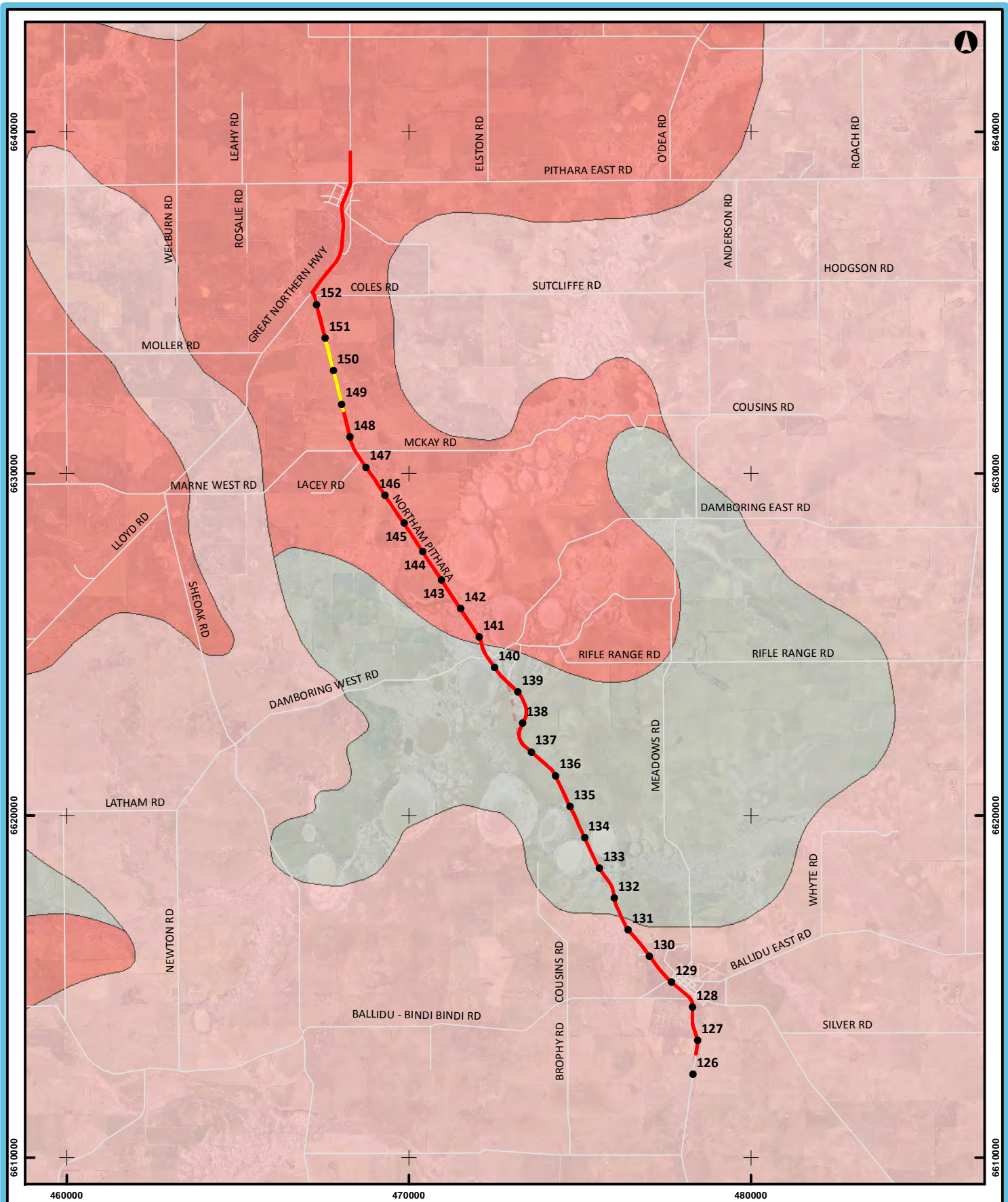
The specific soils and underlying surface geology of the Project Area are described in Table 1 and Table 2 and are illustrated in Figure 3.

**Table 1 Soil types of the Project Area (Source: Bureau of Rural Science, 1991)**

Soil type	Description
Va66	Gently undulating to rolling terrain with some ridges and uneven slopes; and with the variable presence of lateritic mesas and buttes and granitic tors and bosses: chief soils are hard alkaline yellow mottled soils (Dy3.43) and hard alkaline red soils (Dr2.33), (Dr3.33), and (Dr2.43), either of which may be dominant locally. Associated are a variety of soils, notably (Dy) soils such as (Dy3.82 and Dy3.83) and (Dr) soils such as (Dr3.32). Acid lateritic strata are common below 4-5 ft. As mapped, lateritic mesas and buttes of unit Ms8 soils are a constant feature, as are small granitic bosses and tors of unit JJ16 and minor valleys of units SI28, Oc31, and Vb2. Western occurrences of this unit have some features transitional to unit Uf1, especially the larger areas of (Dy3.82) soils
Va70	Valley plains and terraces: chief soils are hard alkaline yellow mottled soils (Dy3.43). Associated are small areas of other soils including (Gc1.22) and (Gc1.12) and the soils of adjoining units
SV1	Saline valleys and salt lakes--salt-lake channels, mostly devoid of true soils, and their fringing areas; few fresh-water lakes: common soils are gypseous and saline loams (Um1.1 and Um1.2) on riverine wash and usually underlain by clayey or sandy strata by about 12 in. Associated are various resalinized (Dy) soils such as (Dy4.83) on fringe areas, and dunes and lunettes of various sandy (Uc), silty (Um), and clayey (Uf) soils of slight profile development. Deposits of common salt, gypsum, lime, and alunite occur as do remnants of the old lateritic profile and occasionally outcrops of country rock
DD17	Undulating land: chief soils are brown calcareous earths (Gc1.12) and (Gc1.22) with some low gilgais, and loamy red and yellow earths (Gn2.12) and (Gn2.2) with soil dominance varying locally between the (Gc) and (Gn) soils. Associated are flats of (Gn2.13) soils and small areas of the soils of adjoining units
Ms8	Gently undulating plains with broad shallow drainage depressions: a wide range of loamy yellow earths and related soils occurs but (Gn2.22) is probably most common. On higher landscape sites (Gn2.21, Gn2.24, and Gn2.25) are commonly associated. In slightly depressed areas (Gn2.35), (Gn2.95), (Gn2.34), and (Gn2.55) all may occur locally. All of these earth soils commonly contain a horizon of ironstone nodules at 30 36 in. and occasionally at shallower depths. In the broad shallow drainage depressions loamy duplex soils occur, chiefly (Dy2.43), (Dy3.43), and (Dy3.42), together with some grey leached earths (Gn2.95) and (Gn2.85). Also occurring in the unit as mapped are very small areas of loamy red earths (Gn2.12 and Gn2.11) and small inclusions of slightly gilgaied clays (Ug5.24)

Table 2 Surface geology of the Project Area (Source: Geological Survey of WA and Geoscience Australia, 2008)

Map unit and unit name	Surface geology type	Description
Ag – felsic intrusives 74292	Monzogranite, granodiorite, granite, tonalite, quartz monzonite	Undifferentiated felsic intrusive rocks, including monzogranite, granodiorite, granite, tonalite, quartz monzonite, syenogranite, diorite, monzodiorite, pegmatite. Locally metamorphosed, foliated, gneissic. Local abundant mafic and ultramafic inclusions
Qrc – colluvium 38491	Colluvial sediment	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
Czs – sand plain 38499	Sand - residual	Sand or gravel plains; quartz sand sheets commonly with ferruginous pisoliths or pebbles, minor clay; local calcrete, laterite, silcrete, silt, clay, alluvium, colluvium, Aeolian sand
Czl – ferruginous duricrust 38498	Lateritic duricrust	Pisolitic, nodular or vuggy ferruginous laterite; some lateritic soils; ferricrete; magnesite; ferruginous and siliceous duricrusts and reworked products, calcrete, kaolinised rock, gossan; residual ferruginous saprolite
Qa – alluvium 38485	Alluvial sediment	Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted
An – gneiss, granulite, migmatite 74310	Felsic, gneiss, mafic granulite, felsic granulite, banded iron formation, migmatite	Banded granitic gneiss (monzogranitic to granodioritic), quartzofeldspathic gneiss with mafic bands, migmatite, granofels, mafic and felsic granulites, hypersthene-plagioclase-quartz granulite; schist, polytomic or mafic granofels
Qt – lake deposits 38492	Lacustrine sediment	Lacustrine or residual mud, clay, silt and sand, commonly gypsiferous and/or saline; playa, claypan, and swamp deposits; peat; peaty sand and clay; halitic and gypsiferous evaporites

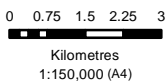


## Soils and Geology

Northam-Pithara Rd DRF

Figure 3

Coordinate System: GDA 1994 MGA Zone 50



### LEGEND

- |   |                           |   |   |
|---|---------------------------|---|---|
|  | Project Area              |  | Granitic rock;<br>monzogranite dominant                 |
|  | Priority Area             |  | Gneiss, undivided                                       |
|  | Proposed Road Realignment |  | Granulite and migmatite;<br>high-grade metamorphic rock |

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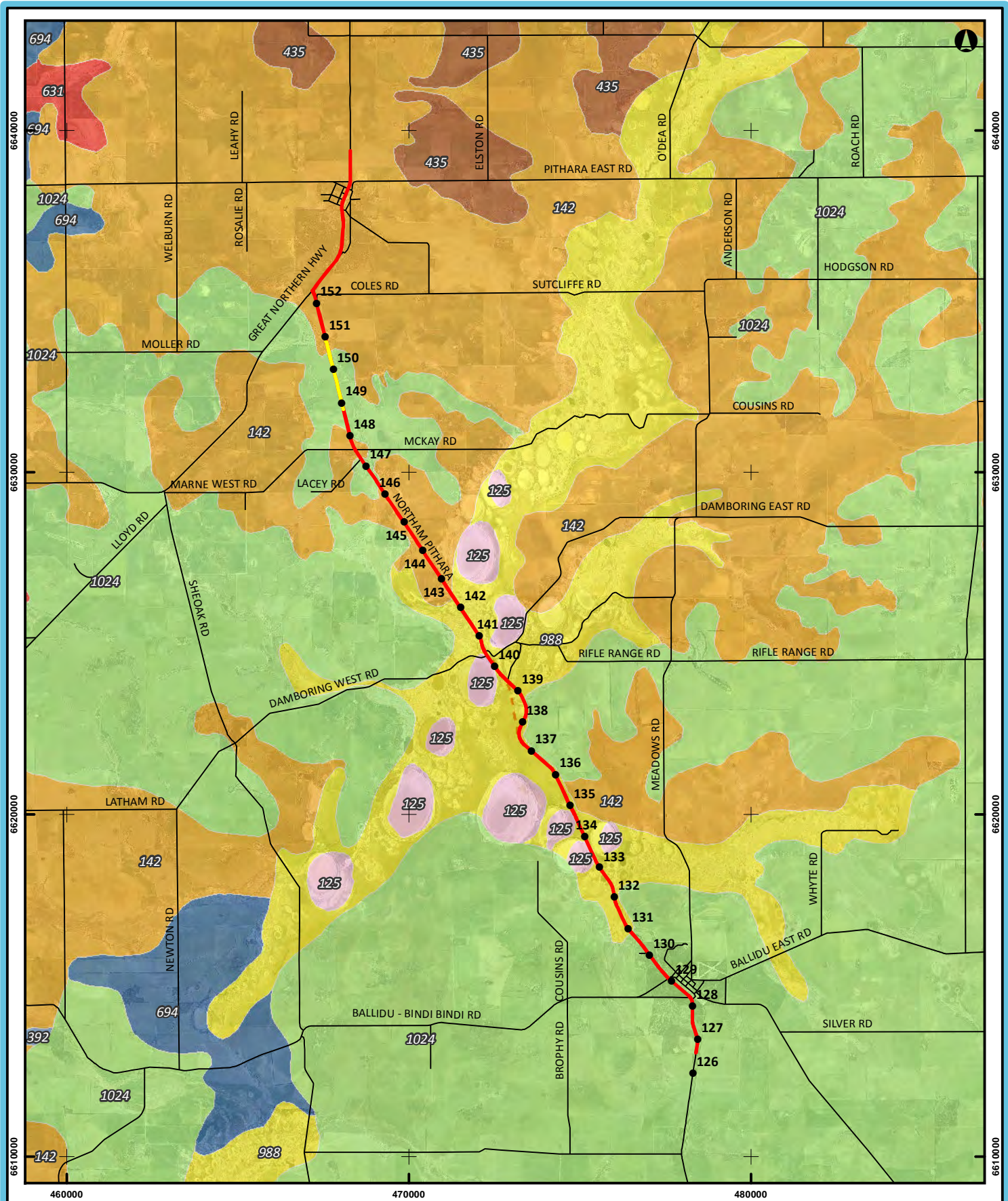
## 2.4 Flora and Vegetation

The Avon Botanical District of the Wheatbelt Region typical comprises of scrub-heath on sandplain, *Acacia-Casuarina* thickets on ironstone gravels, woodlands of York gum (*Eucalyptus loxophleba*), Salmon gum (*E. salmonophloia*) and Wandoo (*E. wandoo*) on loams and halophytes on saline soils.

Beard's (1981) 1:250 000 vegetation series map identifies three broad terrestrial vegetation types that occur within the survey area, plus bare areas comprising of salt lakes. These are described in Table 3 and mapped on Figure 4.

**Table 3** Pre-European vegetation associations of the Project Area

Vegetation association	Beard code	Description
142	e6,8Mi	Medium Woodland; York Gum ( <i>Eucalyptus loxophleba</i> ) and Salmon Gum ( <i>E. salmonophloia</i> )
1024	ecSc	Shrublands; Mallee ( <i>Acacia</i> spp.) and <i>Casuarina</i> Thickets
125	sl	Bare areas, salt lakes
988	m55c k3Ci	Succulent steppe with thicket, <i>Melaleuca thyoides</i> over samphire

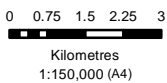


### Pre-European Vegetation

Northam-Pithara Rd DRF

Figure 4

Coordinate System: GDA 1994 MGA Zone 50



#### LEGEND

- |                                |                           |  |     |
|--------------------------------|---------------------------|--|-----|
|                                | Project Area              |  | 142 |
|                                | Priority Area             |  | 392 |
|                                | Proposed Road Realignment |  | 435 |
| Vegetation Associations (Bead) |                           |  | 631 |
|                                | 1024                      |  | 694 |
|                                | 125                       |  | 988 |

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## 3.0 Legislative Framework

Flora species that are considered at risk of becoming extinct are protected under both State and Commonwealth legislation (refer to Sections 3.1 and 3.2). This survey focused on those flora species that are considered a significant environmental constraint including species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Western Australian *Wildlife Conservation Act 1950* (WC Act), as well as species that are a priority for conservation and preventing further population decline. Significant environmental factors such as these can have large implications for the impact assessment and viability of the road corridor alignment.

### 3.1 Commonwealth Listed Species

The EPBC Act provides for the protection of threatened native species. Threatened flora species are listed within one of the categories defined under Section 179 of the EPBC Act (Table 4). Once a species is listed under the EPBC Act its recovery is promoted using conservation advice, recovery plans and the EPBC Act's assessment and approval provisions. As a Matter of National Environmental Significance, a person must not undertake an action that has, will have, or is likely to have, a significant impact on a listed threatened species without approval from the Commonwealth Minister for the Environment, which would require the action to undergo an environmental assessment and approval process.

Table 4 Conservation categories under the EPBC Act (adapted from definitions in Section 179 of the EPBC Act)

Conservation Code	Category
<b>Ex</b>	<b>Extinct</b> - there is no reasonable doubt that the last member of the species has died
<b>ExW</b>	<b>Extinct in the wild</b> - the species: a) is known only to survive in cultivation or as a naturalised population well outside its past range; or b) has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form
<b>CE</b>	<b>Critically endangered</b> - the species is facing an extremely high risk of extinction in the wild in the immediate future
<b>EN</b>	<b>Endangered</b> - the species is facing a very high risk of extinction in the wild in the near future
<b>VU</b>	<b>Vulnerable</b> - the species is facing a high risk of extinction in the wild in the medium term future
<b>CD</b>	<b>Conservation dependent</b> - 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.

### 3.2 State Listed Species

In Western Australia, flora of conservation significance are protected under the State WC Act, which provides for Threatened flora species to be listed under Schedule 1 of the Wildlife Conservation (Rare Flora) Notice if they are likely to become extinct, rare, or otherwise in need of special protection.

Flora species listed as Threatened under the Wildlife Conservation (Rare Flora) Notice are further recognised by the Department of Parks and Wildlife (DPaW) according to their level of threat using the International Union for Conservation of Nature (IUCN) Red List criteria (Table 5).



Table 5 Threatened flora rankings under the IUCN Red List criteria (DPaW, 2014)

Conservation Ranking	Description
CR	<b>Critically Endangered</b> - considered to be facing an extremely high risk of extinction in the wild
EN	<b>Endangered</b> – considered to be facing a very high risk of extinction in the wild
VU	<b>Vulnerable</b> - considered to be facing a high risk of extinction in the wild

Species that have not been adequately surveyed in order to be listed under the Wildlife Conservation (Rare Flora) Notice are added to the Priority Flora Lists under Priorities 1, 2 or 3 and ranked in order of priority for survey and evaluation of conservation status. Species and communities that 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, are placed in Priority 4. Conservation Dependent species and ecological communities are placed in Priority 5 (Table 6).

Table 6 DPaW flora Priority rankings (abbreviated from DPaW, 2014)

Priority Code	Description
<b>P1</b>	<b>Priority One: Poorly-known species</b> Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation and under threat of habitat destruction or degradation.
<b>P2</b>	<b>Priority Two: Poorly-known species</b> Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation.
<b>P3</b>	<b>Priority Three: Poorly-known species</b> Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat
<b>P4</b>	<b>Priority Four: Rare, Near Threatened and other species in need of monitoring</b> , including: 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 do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
<b>P5</b>	<b>Priority Five: Conservation Dependent species</b> Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

## 4.0 Methodology

### 4.1 Desktop Assessment

A desktop assessment was completed to identify DRF or Priority Flora species that may occur within or in the vicinity of the Project Area. A database search of the DPaW and Western Australian Herbarium (WAH) databases was conducted with a 15km buffer applied to provide regional context to database records.

In addition to the database searches, results of the Level 2 flora and vegetation assessment for the project from the *Northam-Pithara Road Biological Assessment: Ballidu to Pithara* (AECOM, 2012) were also reviewed. The database searches enabled additional DRF and Priority Flora species not identified in the original assessment of the Project Area to be included.

A comprehensive target species list was developed. Each species was reviewed to determine known records and proximity to the Project Area, habitat, species description, flowering period, and the ideal survey season.

### 4.2 Targeted Species Search

A targeted survey was conducted within the Project Area from SLK 129.12 to SLK 152.25. The width of the Project Area was 15 m either side of the road centreline, making the clearing footprint a total width of 30 m. A 200 m survey buffer around the road centreline was applied. This enabled population boundaries to be extended beyond the Project Area footprint and to provide some flexibility in road design around recorded populations.

The field survey was conducted in September 2014 by Senior Botanist Catherine Krens (Flora Collection Permit no. SL011087) and Environmental Scientist Lyn Van Gorp (Flora Collection Permit no. SL011084). The timing of the survey (during spring) was selected in order to capture the flowering periods of the more significant flora species (DRF and Priority 1 flora species).

Flora searches were conducted systematically at defined locations and involved traversing the area on foot and walking meandering transects within suitable habitat and extending outside the Project Area footprint to determine population boundaries. The search methods employed were based on known species habitats.

For each population of Threatened and Priority flora identified within the Project Area the following data were recorded:

- species name
- GPS location (GDA94) of the central point of each population
- number of individuals in the population
- reproductive phase (e.g. flowering, fruiting)
- photograph of the species.

Populations were mapped by recording the GPS coordinate of the central point of the population within 10m<sup>2</sup> and recording the number of individuals present. For very large populations consisting of greater than 50 individuals, the boundary of a population was mapped and an estimate of population size recorded. Searches were extended outside the Project Area where necessary to provide quantitative data for use in the environmental assessment and approvals process.

#### 4.2.1 Identification of Conservation Significant Species

Where potential DRF and Priority Flora species were encountered, a sample was taken for taxonomic identification. To aid in recognising individuals during the survey a field herbarium was maintained and photographs taken of the species in situ.

Specimens were verified at the Western Australian Herbarium (WAH) using the WAH reference flora collection and taxonomic keys and references. Where a specimen was identified to potentially be a DRF or Priority flora species, it was submitted to the WAH for confirmation by specialist taxonomists.

Rare Flora Report Forms will be completed and lodged with DPaW for populations of confirmed DRF and Priority Flora species.

### 4.3 Level 2 Flora and Vegetation Survey – Realignment Section

There are two sections of the Northam Pithara Road requiring realignment due to substandard curves and sight lines, these sections are:

- SLK 136.82 to 139.57
- SLK 140.27 to 141.33.

A Level 2 flora and vegetation survey was undertaken within the proposed realignment section. The survey was undertaken in accordance with EPA Guidance Statement 51 and involved recording all flora species present and mapping vegetation communities and condition using quadrat sampling units. At each quadrat the following parameters were recorded:

- site number
- date
- recorder
- GPS location
- soil type
- topography
- species present
  - height
  - foliage cover
- vegetation condition using the Keighery (1994) scale
- disturbance
- fire history

The vegetation community and condition mapping of the realignment section was combined with the previous vegetation community and condition mapping of the Project Area (AECOM, 2011). The addition of the previous mapping provides continuity of vegetation mapping for the Project Area.



## 5.0 Results

### 5.1 Desktop Assessment

The desktop assessment examined the 31 DRF and Priority Flora species identified in the previous assessment of the Project Area (AECOM, 2012). A DPaW database search was conducted in September 2014 to identify additional DRF and Priority Flora species occurring in the vicinity of the Project Area, a further 17 DRF and Priority Flora species were identified, totalling 48 DRF and Priority Flora species (Appendix A) potentially occurring within the Project Area. This included:

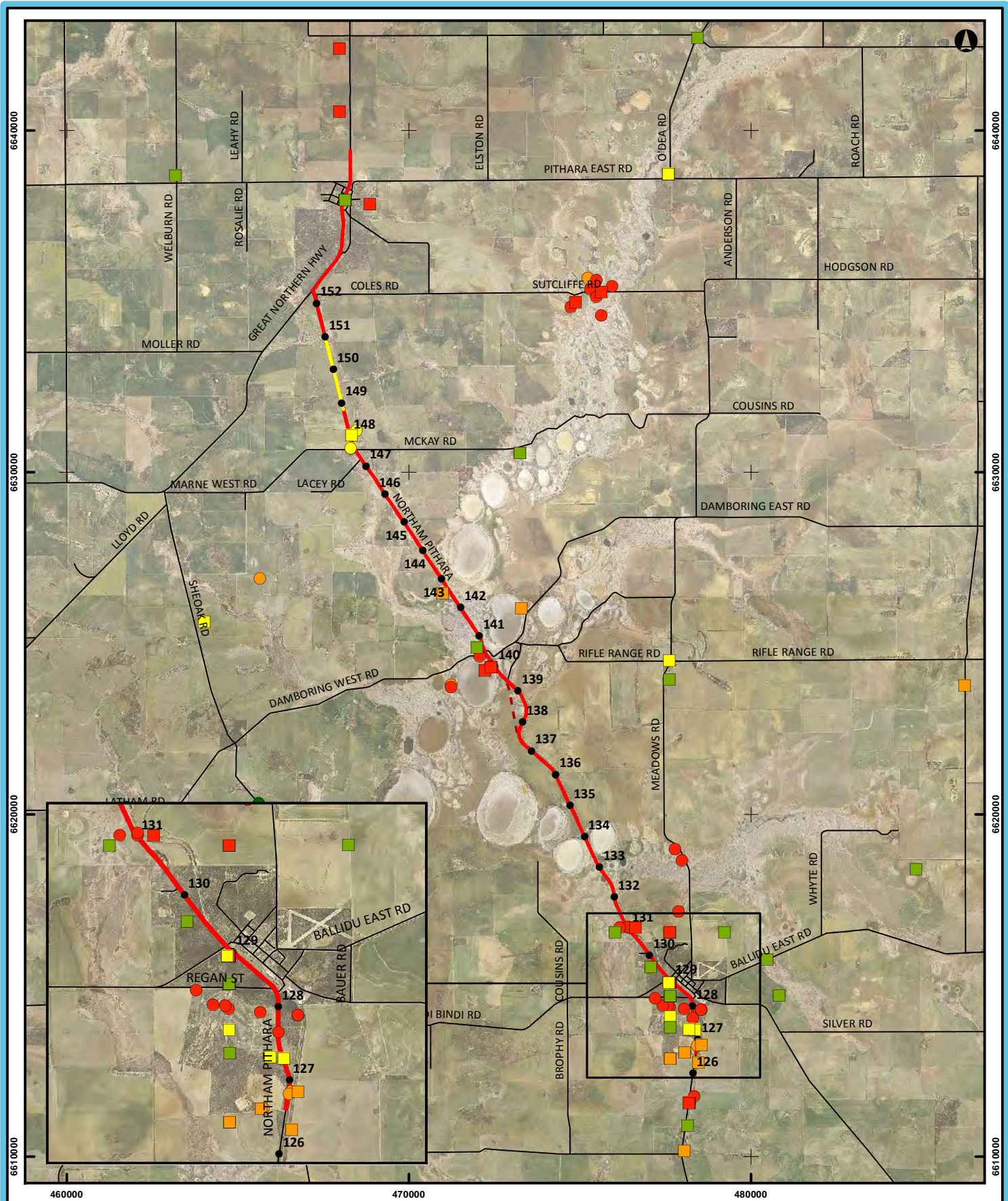
- 11 Schedule 1 Threatened flora species
  - Five Critically Endangered species (EPBC Act listed)
  - Three Endangered species (EPBC Act listed)
  - Two Vulnerable species (EPBC Act listed)
- 38 Priority flora species.

The locations of conservation significant species occurring in the vicinity of the Project Area are provided in Figure 5.

A breakdown of the 48 DRF and Priority Flora species identified in the database searches is provided in Appendix A. This includes descriptions of these species, their likelihood of occurrence within the Project Area, preferred habitat and flowering period.

The potential DRF and Priority Flora species identified in the database searches represents the known populations within a 15km radius of the Project Area. It does not consider records that are located outside this area. The assessment of likelihood of occurrence included:

- those known to occur within the Project Area
- those likely to occur, due to close proximity or suitable habitat
- those that may occur, due to close proximity but unknown whether suitable habitat is present.

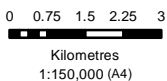


### Known Conservation Significant Species




Northam-Pithara Rd DRF

Figure 5

Coordinate System: GDA 1994 MGA Zone 50



### LEGEND

	Project Area		DPaW TPFL T		WA Herb T
	Priority Area		DPaW TPFL 1		WA Herb 1
	Proposed Road Realignment		DPaW TPFL 2		WA Herb 2
			DPaW TPFL 3		WA Herb 3
			DPaW TPFL 4		WA Herb 4

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## 5.2 Targeted Flora Search

It was considered that eight species are likely to occur and 25 species may occur within the Project Area. The remaining 15 species are considered not likely to occur within the Project Area. The targeted survey focused on those species that are likely to or may occur within the Project Area and those with a high conservation status. Species focused on during the targeted survey and areas searched are provided in Table 7.

A total of seven DRF and Priority Flora species were recorded within the Project Area. This includes:

- Two DRF species
  - *Eremophila viscida* (Endangered)
  - *Frankenia conferta* (Vulnerable)
- One Priority 1 species – *Dampiera glabrescens*
- One Priority 2 species – *Acacia lirellata* subsp. *compressa*
- Three Priority 3 species
  - *Acacia dissona* var. *indoloria*
  - *Acacia scalena*
  - *Podotheca uniseta*

One species found during the 2012 survey, *Grevillea dryandroides* subsp. *dryandroides* was extensively searched for, however no populations were recorded during the targeted survey. Search effort included around known locations and extending up to 200 m from known locations, in all suitable habitats (plains of yellow gravelly sands and clay).

A description of the recorded DRF and Priority Flora species, locations of populations and number of individuals recorded are provided below in Section 5.2.1 to 5.2.7.

Table 7 Species focused on during the targeted survey

Species	Conservation status	Habitat	Areas searched
<b>Species considered Likely to Occur within the Project Area</b>			
<i>Grevillea dryandroides</i> subsp. <i>dryandroides</i>	DRF – Schedule 1 (WC Act) Critically Endangered (EPBC Act)	Yellow sand & gravel, clay.	Around known populations and within vegetation communities in which this species was previously mapped
<i>Frankenia conferta</i>	DRF – Schedule 1 (WC Act) Endangered (EPBC Act)	Salt lakes	Around existing populations and along salt lake fringes
<i>Caladenia cristata</i>	Priority 1	Sandy clay. Sandy rise above salt flats, freshwater.	Around the known population and within vegetation around salt lake fringes
<i>Dampiera glabrescens</i>	Priority 1	White or grey/yellow sand. Gravel pits, roadsides.	Around known populations, along the road verge and degraded areas
<i>Acacia lirellata</i> subsp. <i>compressa</i>	Priority 2	Yellow sand, clayey loam. Sandplains.	Around known populations, along road verges particularly around Ballidu and within vegetation communities that this species was previously mapped in
<i>Acacia dissona</i> var. <i>indoloria</i>	Priority 3	Sand, sandy loam. Undulating plains.	Around known locations and along sections of road verge and disturbed areas
<i>Acacia scalena</i>	Priority 3	Yellow or yellow gravelly sand, loam. Plains and road verges.	Around known locations and along road verges, particularly near Ballidu
<i>Synaphea constricta</i>	Priority 3	Sand or sandy clay-loam over laterite. Plains and slopes	Around known populations and within vegetation communities that this species was previously mapped in
<b>Species considered to May Occur within the Project Area</b>			
<i>Caladenia drakeoides</i>	DRF – Schedule 1 (WC Act) Critically Endangered (EPBC Act)	Margins of saltlakes	Along fringes of salt lakes
<i>Eremophila pinnatifida</i>	DRF – Schedule 1 (WC Act) Critically Endangered (EPBC Act)	Clay and loam soils. Plains, low lying areas and along road verges	Along lower lying sections of the road verges
<i>Grevillea pythara</i>	DRF – Schedule 1 (WC Act) Critically Endangered (EPBC Act)	Sand or sandy loam with gravel.	Along the road verge particularly near Pithara
<i>Eremophila viscida</i>	DRF – Schedule 1 (WC Act) Endangered (EPBC Act)	Granitic soils, sandy loam. Stony gullies, sandplains.	Around known populations and vegetation above salt lakes
<i>Acacia</i> sp. Petrudor Rocks (B.R. Maslin 7714)	Priority 1	Loam or clayey loam over granite. Upper slopes of catchment area.	Within vegetation around Ballidu and areas with heavier clay loam soils

Species	Conservation status	Habitat	Areas searched
<b>Species considered Likely to Occur within the Project Area</b>			
<i>Acacia trinalis</i>	Priority 1	Brown sand, clay loam. Salt lakes & flats, swampy areas.	Around salt lakes
<i>Caladenia x ornata</i>	Priority 1	Sandy clay. Margins salt lakes, slight rises, under <i>Melaleuca</i> and <i>Acacia acuminata</i> .	Around salt lakes and within vegetation communities containing <i>Acacia acuminata</i>
<i>Verticordia roei</i> subsp. <i>meiogona</i>	Priority 1	Yellow sand, sandy loam with gravel. Roadside verges.	Along road verges, particularly in the northern end of the Project Area near Pithara
<i>Boronia ericifolia</i>	Priority 2	Sandy loam, clay, laterite. Low-lying spots.	Around known locations and in vegetation above salt lakes
<i>Angianthus micropodioides</i>	Priority 3	Saline sandy soils. River edges, saline depressions, claypans	Around salt lakes
<i>Calytrix plumulosa</i>	Priority 3	Sand with lateritic gravel, loamy soils. Plains	Throughout the Project Area with a focus on the northern end of the Project Area
<i>Chamelaucium</i> sp. Wongan Hills (B.H. Smith 1140)	Priority 3	Sand, sandy loam, low lying flats and margins of salt lakes	Around salt lakes
<i>Dicrastylis velutina</i>	Priority 3	Sandy soils, gravelly loam. Salt lakes	Around salt lakes
<i>Gompholobium wonganense</i>	Priority 3	Sand, laterite. Among hills.	Around hilly areas
<i>Goodenia perryi</i>	Priority 3	Yellow sand. On sand plains	Throughout the Project Area except salt lakes
<i>Grevillea asparagoides</i>	Priority 3	Gravelly loam, white or yellow sand. Slopes, plains and road verges.	Along road verges
<i>Grevillea candicans</i>	Priority 3	Deep yellow sand. Sandplains.	Throughout the Project Area except salt lakes
<i>Gunniopsis rubra</i>	Priority 3	Sandy loamy clay. Flats and foot of slopes.	Within lower lying sections of the Project Area
<i>Lepidobolus densus</i>	Priority 3	Yellow lateritic sand, lateritic gravel. Dry kwongan.	Throughout the Project Area except salt lakes
<i>Podotheca unisetata</i>	Priority 3	White/grey sand, sandy loam. Sapphire flats, salt lake areas.	Around salt lakes

Species	Conservation status	Habitat	Areas searched
<b>Species considered Likely to Occur within the Project Area</b>			
<i>Tecticornia fimbriata</i>	Priority 3	Clay, loam. Margins of salt & gypsum lakes.	Around salt lakes
<i>Urodon capitatus</i>	Priority 3	Sandy gravelly soils. Plains.	Throughout the Project Area except salt lakes
<i>Verticordia venusta</i>	Priority 3	Yellow sand, sandy gravel. Sandplains.	Throughout the Project Area except salt lakes



### 5.2.1 *Eremophila viscida*

*Eremophila viscida* is listed as DRF – Schedule 1 under the WC Act and Endangered under the EPBC Act, as there are few populations spread over a wide geographical area. If current circumstances do not change, a gradual reduction in plant numbers and number of populations is likely to occur due to senescence, resulting in a slow decline in area of occupancy and extent of occurrence. The main threats are poor recruitment due to inadequate disturbance, weeds, salinity and waterlogging, silting, erosion, inappropriate fire regimes, maintenance activities for roads, tracks, powerlines and firebreaks, grazing and disturbance by stock and feral animals, and chemical drift (Phillimore *et. al.* 2003).

*Eremophila viscida* is a large, erect shrub 2 to 6 m tall with sticky, shiny, brown, hairless branches and hairless to finely glandular-hairy leaves 5 to 10 cm long by 1 cm wide (Plate 1). The flowers are tubular, about 2 cm long, and are solitary or sometimes in twos. Each flower is on a 1 cm long stalk, which is enlarged beneath the flower. The calyx lobes are 7 mm long, greyish-blue or reddish in colour and are strongly veined. The corolla is white to pale yellow with purple spots. The stamens project beyond the floral tube. (Phillimore *et. al.* 2003).



Plate 1 *Eremophila viscida*

Preferred habitat is brown, sandy loam or red brown clay-loam soils, in open woodland in association with *Eucalyptus loxophleba* and scrub vegetation (Mollemans *et al.* 1993). It appears to prefer areas that are associated with granite and salt lake systems and plants are particularly frequent in runoff areas, including drainage lines or ephemeral creeks connected to granite outcrops.

There are currently 16 populations containing 816 mature plants currently known between Merredin and Mullewa. One population of *Eremophila viscida* was recorded during the targeted survey, which is most likely one of the 16 already known populations. This population was located approximately 250m outside the Project Area, adjacent to Damboring West Road. The population contained a total of four individuals (Table 8). Other salt lake habitats throughout the Project Area were searched. As *Eremophila viscida* is a large shrub to 2 m, it was relatively easy to spot from a distance, therefore it was considered all populations were captured during the survey. *Eremophila viscida* was flowering at the time of survey. The location of the *Eremophila viscida* population is listed in Table 8 and mapped on Figure 6.

Table 8 Populations of *Eremophila viscida*

Species	Population number	Location	Latitude	Longitude	Number of individuals
<i>Eremophila viscida</i>	323	Approximately 250m west of Project Area along Damboring West Road	-30.510499	116.7085	4

### 5.2.2 *Frankenia conferta*

*Frankenia conferta* is listed as DRF – Schedule 1 under the WC Act and Vulnerable under the EPBC Act, due to the limited area of occupancy and number of locations, and a continuing decline in the area, extent and/or quality of habitat. The main threat to the species is changes to hydrology from rising salinity and waterlogging (Luu and Brown, 2008).

*Frankenia conferta* is a small shrub with the stems, leaves and calyx covered with short, soft hairs (Plate 2). The stalkless, linear leaves are clustered at the nodes of the stem. They are 2 to 5 mm long, 1 mm wide and their margins are recurved to cover the midrib. Each pair of leaves is united by a sheath, edged with fine hairs. Flowers are grouped in dense heads at the tops of the branches. The calyx is a pleated tube, 3.5 to 4.7 mm long. The flowers are 6 to 8mm long and have five petals, which are usually pale pink (Luu and Brown, 2008).

Plate 2 *Frankenia conferta*

Preferred habitat is clayey soils on the edge of salt lakes. Within the Project Area it occurred in loamy clay above salt lake fringes. *Frankenia conferta* is widely distributed between Koorda, Dalwallinu, Perenjori and Coorow (Luu and Brown, 2008).

There are 24 known populations of *Frankenia conferta*. One of the known populations was found during the Targeted Survey, however additional populations are likely to have been recorded during the Targeted Survey. One population was found within the Project Area between SLK 140.5 and 140.6 and a number of populations were recorded extending over 200 m outside the Project Area, occurring along salt lake fringes above the high water mark. *Frankenia conferta* was flowering at the time of survey. All populations recorded during the Targeted Survey are listed in Table 9 and mapped in Figure 6.

**Table 9 Populations of *Frankenia conferta***

Species	Population number	Location	Latitude	Longitude	Number of individuals
<i>Frankenia conferta</i>	305	Approximately 110m west (outside) of the Project Area south of Damboring West Road	-30.513718	116.7124	8
<i>Frankenia conferta</i>	308	Approximately 150m west (outside) of the Project Area south of Damboring West Road	-30.514944	116.713	40
<i>Frankenia conferta</i>	449	Inside the Project Area between SLK 140.5 to 140.6	-30.509197	116.7103	50
<i>Frankenia conferta</i>	452	Approximately 90m west (outside) of the Project Area north of Damboring West Road	-30.509474	116.7095	100
<i>Frankenia conferta</i>	455	Approximately 130m west (outside) of the Project Area north of Damboring West Road	-30.50977	116.7091	20
<i>Frankenia conferta</i>	524	Approximately 140m west (outside) of the Project Area south of Damboring West Road	-30.51399	116.7125	8
<i>Frankenia conferta</i>	527	Approximately 120m west (outside) of the Project Area south of Damboring West Road	-30.514171	116.7126	6

### 5.2.3 *Dampiera glabrescens*

*Dampiera glabrescens* is listed by DPaW as a Priority 1 species, which are “species known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation and under threat of habitat destruction or degradation” (DPaW, 2014a). *Dampiera glabrescens* was most likely given this conservation status due to its preference for occurring within road reserves which have the potential to be cleared.

*Dampier glabrescens* is a small, erect, grey, pubescent to woolly shrub to 40 cm, with triangular stems (Plate 3). Its leaves are sessile, oblong to lanceolata in shape, and range from 9 to 28 mm long and 2 to 7 mm wide. Flowers are a deep purple to blue situated in panicles along the stem.





Plate 3 *Dampiera glabrescens*

Preferred habitat is within white or grey/yellow sand, on gravel pits, along road verges and degraded areas such as tracks. During the targeted survey, searches were conducted further into native vegetation adjacent to roadside populations, however *Dampiera glabrescens* didn't appear to extend outside the road verge.

There are 11 known population records of *Dampiera glabrescens*. These are located between Dalwallinu and south of Ballidu. Several populations were recorded south of Ballidu during the previous survey of the Project Area (AECOM, 2012). Two of the known populations were found during the targeted survey, additional populations of *Dampiera glabrescens* were recorded extensively along the road verge within and outside the Project Area. *Dampiera glabrescens* was flowering at the time of the survey. All populations recorded during the Targeted Survey are listed in Table 10 and are mapped in Figure 6.



Table 10 Populations of *Dampiera glabrescens*

Species	Population number	Location	Latitude	Longitude	Number of individuals
<i>Dampiera glabrescens</i>	200	Approximately 2km south (outside) of the Project Area between SLK 126 and 127	-30.613074	116.7749	3
<i>Dampiera glabrescens</i>	206	Approximately 2.3km south (outside) of the Project Area between SLK 126 and 127	-30.615234	116.7744	1
<i>Dampiera glabrescens</i>	209	Approximately 1.2 km south (outside) of the Project Area between SLK127 and 128	-30.605893	116.7738	1
<i>Dampiera glabrescens</i>	212	Approximately 1.1km south (outside) of the Project Area between SLK 127 and 128	-30.604298	116.7733	1
<i>Dampiera glabrescens</i>	215	Approximately 1.1km south (outside) of the Project Area between SLK 127 and 128	-30.604506	116.7733	3
<i>Dampiera glabrescens</i>	224	Approximately 1.4km south (outside) of the Project Area between SLK 127 and 128	-30.60721	116.7734	19
<i>Dampiera glabrescens</i>	236	Approximately 1.6km south (outside) of the Project Area between SLK 127 and 128	-30.608978	116.774	12
<i>Dampiera glabrescens</i>	245	Approximately 1.6km south (outside) of the Project Area between SLK 127 and 128	-30.608783	116.7742	17
<i>Dampiera glabrescens</i>	248	Approximately 1.6km south (outside) of the Project Area between SLK 127 and 128	-30.608667	116.7741	25
<i>Dampiera glabrescens</i>	251	Approximately 1.6km south (outside) of the Project Area between SLK 127 and 128	-30.608493	116.7741	11
<i>Dampiera glabrescens</i>	254	Approximately 1.6km south (outside) of the Project Area between SLK 127 and 128	-30.608228	116.774	19
<i>Dampiera glabrescens</i>	260	Approximately 1.5km south (outside) of the Project Area between SLK 127 and 128	-30.607681	116.7737	6
<i>Dampiera glabrescens</i>	266	Approximately 1.5km south (outside) of the Project Area between SLK 127 and 128	-30.607225	116.7736	15
<i>Dampiera glabrescens</i>	269	Approximately 1.5km south (outside) of the Project Area between SLK 127 and 128	-30.607012	116.7736	30

Species	Population number	Location	Latitude	Longitude	Number of individuals
<i>Dampiera glabrescens</i>	272	Approximately 1.5km south (outside) of the Project Area between SLK 127 and 128	-30.606764	116.7736	50
<i>Dampiera glabrescens</i>	275	Approximately 1.5km south (outside) of the Project Area between SLK 127 and 128	-30.606618	116.7736	50
<i>Dampiera glabrescens</i>	458	Approximately 2.2km south (outside) of the Project Area between SLK 126 and 127	-30.614276	116.7748	2
<i>Dampiera glabrescens</i>	461	Approximately 2.2km south (outside) of the Project Area between SLK 126 and 127	-30.614221	116.7747	6
<i>Dampiera glabrescens</i>	467	Approximately 1.9km south (outside) of the Project Area between SLK 126 and 127	-30.611385	116.7749	8
<i>Dampiera glabrescens</i>	470	Approximately 2.3km south (outside) of the Project Area between SLK 126 and 127	-30.614509	116.7745	4
<i>Dampiera glabrescens</i>	473	Approximately 1.4km south (outside) of the Project Area between SLK 127 and 128	-30.605654	116.7737	18
<i>Dampiera glabrescens</i>	476	Approximately 1.4km south (outside) of the Project Area between SLK 127 and 128	-30.605513	116.7737	16
<i>Dampiera glabrescens</i>	479	Approximately 1.3km south (outside) of the Project Area between SLK 127 and 128	-30.605601	116.7736	20
<i>Dampiera glabrescens</i>	482	Approximately 1.4km south (outside) of the Project Area between SLK 127 and 128	-30.605231	116.7733	3
<i>Dampiera glabrescens</i>	488	Approximately 1.5km south (outside) of the Project Area between SLK 127 and 128	-30.607356	116.7734	9
<i>Dampiera glabrescens</i>	500	Approximately 1.7km south (outside) of the Project Area between SLK 127 and 128	-30.60902	116.7735	8
<i>Dampiera glabrescens</i>	512	Approximately 1.4km south (outside) of the Project Area between SLK 127 and 128	-30.606244	116.7736	3
<i>Dampiera glabrescens</i>	515	Approximately 1.4km south (outside) of the Project Area between SLK 127 and 128	-30.606187	116.7737	40

Species	Population number	Location	Latitude	Longitude	Number of individuals
<i>Dampiera glabrescens</i>	641	Inside Project Area between SLK 150.6 and 150.7	-30.428601	116.6629	15
<i>Dampiera glabrescens</i>	644	Inside Project Area between SLK 150.7 and 150.8	-30.428146	116.6627	4
<i>Dampiera glabrescens</i>	650	Inside Project Area between SLK 150.8 and 150.9	-30.426649	116.6623	8

#### 5.2.4 *Acacia lirellata* subsp. *compressa*

*Acacia lirellata* subsp. *compressa* is listed by DPaW as a Priority 2 species, which are “species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation” (DPaW, 2014).

*Acacia lirellata* subsp. *compressa* was most likely given this conservation status as several known populations occur within the Hindmarsh Nature Reserve.

*Acacia lirellata* subsp. *compressa* is a bushy, procumbent, spreading shrub, which grows to 0.5 m high and 1.2 m wide (Plate 4). It has heavily incurved phyllodes (reduced leaves) with three nerves per face and a prominent mid-vein. Flowers are bright yellow, obloid, in sessile pairs and located on the phyllode axils, which occur during September.



Plate 4 *Acacia lirellata* subsp. *compressa*

Preferred habitat is a variety of soils from yellow sand to heavier clayey loam soils, within sandplains. It favours degraded areas and open vegetation along road and rail verges. During the targeted survey, *Acacia lirellata* subsp. *compressa* was found within the road verge around Ballidu, dropping out further into the natural undisturbed bushland.

There are 31 known population records of *Acacia lirellata* subsp. *compressa*, six of which occur close to the Project Area around Ballidu. One population was recorded during the previous survey of the Project Area (AECOM, 2012) between SLK 144 to 145. A number of populations containing only a few individual plants were recorded south of the Project Area during the targeted survey between SLK 127 and 128. *Acacia lirellata* subsp. *compressa* was just finishing flowering at the time of the survey (old flowering material was present). All populations recorded during the Targeted Survey area listed in Table 11 and are mapped in Figure 6.



Table 11 Populations of *Acacia lirellata* subsp. *compressa*

Species	Population number	Location	Latitude	Longitude	Number of individuals
<i>Acacia lirellata</i> subsp. <i>compressa</i>	218	Approximately 1.5km south (outside) of the Project Area between SLK 127 and 128	-30.606536	116.7733	2
<i>Acacia lirellata</i> subsp. <i>compressa</i>	221	Approximately 1.4km south (outside) of the Project Area between SLK 127 and 128	-30.606785	116.7734	4
<i>Acacia lirellata</i> subsp. <i>compressa</i>	227	Approximately 1.5km south of (outside) the Project Area between SLK 127 and 128	-30.607534	116.7735	3
<i>Acacia lirellata</i> subsp. <i>compressa</i>	230	Approximately 1.6km south (outside) of the Project Area between SLK 127 and 128	-30.608313	116.7737	3
<i>Acacia lirellata</i> subsp. <i>compressa</i>	233	Approximately 1.6km south (outside) of the Project Area between SLK 127 and 128	-30.608925	116.774	1
<i>Acacia lirellata</i> subsp. <i>compressa</i>	239	Approximately 1.8km south (outside) of the Project Area between SLK 127 and 128	-30.609325	116.7745	1
<i>Acacia lirellata</i> subsp. <i>compressa</i>	242	Approximately 1.6km south (outside) of the Project Area between SLK 127 and 128	-30.608796	116.7742	2
<i>Acacia lirellata</i> subsp. <i>compressa</i>	257	Approximately 1.6km south (outside) of the Project Area between SLK 127 and 128	-30.607786	116.7738	1
<i>Acacia lirellata</i> subsp. <i>compressa</i>	263	Approximately 1.6km south (outside) of the Project Area between SLK 127 and 128	-30.607615	116.7737	1
<i>Acacia lirellata</i> subsp. <i>compressa</i>	485	Approximately 1.5km south (outside) of the Project Area between SLK 127 and 128	-30.607324	116.7734	2
<i>Acacia lirellata</i> subsp. <i>compressa</i>	491	Approximately 1.7km south (outside) of the Project Area between SLK 127 and 128	-30.60842	116.7737	1

Species	Population number	Location	Latitude	Longitude	Number of individuals
<i>Acacia lirellata</i> subsp. <i>compressa</i>	494	Approximately 1.6km south (outside) of the Project Area between SLK 127 and 128	-30.608842	116.7732	1
<i>Acacia lirellata</i> subsp. <i>compressa</i>	497	Approximately 1.7km south (outside) of the Project Area between SLK 127 and 128	-30.60891	116.7734	2
<i>Acacia lirellata</i> subsp. <i>compressa</i>	503	Approximately 1.7km south (outside) of the Project Area between SLK 127 and 128	-30.608492	116.7742	3
<i>Acacia lirellata</i> subsp. <i>compressa</i>	506	Approximately 1.6km south (outside) of the Project Area between SLK 127 and 128	-30.608252	116.7741	2
<i>Acacia lirellata</i> subsp. <i>compressa</i>	509	Approximately 1.6km south (outside) of the Project Area between SLK 127 and 128	-30.607968	116.7739	6

### 5.2.5 *Acacia dissona* var. *indoloria*

*Acacia dissona* var. *indoloria* is listed by DPaW as a Priority 3 species, which are “species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat” (DPaW, 2014).

*Acacia dissona* var. *indoloria* is most likely listed with this conservation status due to populations occurring within several nature reserves.

It is a medium compact rounded shrub to 2 m, with bright green phyllodes which are terete and have a distinctive brown coarsely pungent angled tip (Plate 5). It has yellow globular flowers at the leaf axis which occur from August to September.



Plate 5 *Acacia dissona* var. *indoloria*

Preferred habitat is within loamy sandy brown soils on undulating plains. It occurs along the roadside and degraded areas, preferring open areas with scattered vegetation.

There are 18 known population records of *Acacia dissona* var. *indoloria*. Most populations are further south between Wongan Hills and Bruce Rock. One population of *Acacia dissona* var. *indoloria* was recorded during the previous survey of the Project Area (AECOM, 2012) between SLK 144 and 145. An additional 11 small populations of *Acacia dissona* var. *indoloria* were recorded during the targeted survey along the road and rail reserve within the priority area in the northern section of the Project Area between SLK 150.6 to 150.9. *Acacia dissona* var. *indoloria* was finishing flowering during the time of the survey (old flowering material was present). All populations recorded during the Targeted Survey are listed in Table 12 and mapped in Figure 6.

Table 12 Populations of *Acacia dissona* var. *indoloria*

Species	Population number	Location	Latitude	Longitude	Number of individuals
<i>Acacia dissona</i> var. <i>indoloria</i>	395	Approximately 15m east (outside) of Project Area between SLK 150.9 and 151.0	-30.426707	116.6626	2
<i>Acacia dissona</i> var. <i>indoloria</i>	398	Approximately 20m east (outside) of Project Area between SLK 150.8 and 150.9	-30.427457	116.6629	3

Species	Population number	Location	Latitude	Longitude	Number of individuals
<i>Acacia dissona</i> var. <i>indoloria</i>	404	Approximately 5m east (outside) of Project Area between SLK 150.7 and 150.8	-30.427744	116.6628	3
<i>Acacia dissona</i> var. <i>indoloria</i>	653	Inside Project Area between SLK 150.8 and 150.9	-30.4269	116.6625	1
<i>Acacia dissona</i> var. <i>indoloria</i>	656	Approximately 3m east (outside) of Project Area between SLK 150.8 and 150.9	-30.427146	116.6626	2
<i>Acacia dissona</i> var. <i>indoloria</i>	659	Approximately 1m east (outside) of Project Area between SLK 150.8 and 150.9	-30.427297	116.6626	1
<i>Acacia dissona</i> var. <i>indoloria</i>	662	Inside Project Area between SLK 150.8 and 150.9	-30.427526	116.6626	7
<i>Acacia dissona</i> var. <i>indoloria</i>	665	1m east (outside) of Project Area between SLK 150.8 and 150.9	-30.42765	116.6627	3
<i>Acacia dissona</i> var. <i>indoloria</i>	668	Inside Project Area between SLK 150.7 and 150.8	-30.428377	116.6629	5
<i>Acacia dissona</i> var. <i>indoloria</i>	671	2m east (outside) of Project Area between SLK 150.6 and 150.7	-30.429062	116.6631	2
<i>Acacia dissona</i> var. <i>indoloria</i>	674	Approximately 1m outside of Project Area between SLK 150.6 and 150.7	-30.429239	116.6632	2

### 5.2.6 *Acacia scalena*

*Acacia scalena* is listed by DPaW as a Priority 3 species, which are “species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat” (DPaW, 2014).

*Acacia scalena* was most likely given this conservation status as there are a large number of populations, some of which occur in nature reserves.

*Acacia scalena* is a low grey brown shrub to 1.5 m, with glaucous, pungent phyllodes with needle-like points and a prominent mid-rib near the lower margin (Plate 6). It has globular flower heads on a long pedicel which occurs from June to September. It has curly, undulate pods which hold mottled seeds.





**Plate 6** *Acacia scalena*

Preferred habitat is within yellow gravelly sand or loam on plains and road verges. During the targeted survey it was recorded along road verges and within degraded areas around Ballidu, however it was also found at short distances further into the bushland where the vegetation opens out.

*Acacia scalena* has a widespread distribution from Merredin in the south to Perenjori in the north. One population was recorded during the previous survey of the Project Area (AECOM, 2012) south of Ballidu. There are several known population records around Ballidu, of which some were found south of the Project Area during the targeted survey between SLK 128.5 to 129.8, however it is likely the survey found additional populations. *Acacia scalena* was fruiting at the time of the survey. All populations recorded during the targeted survey are listed in Table 13 and mapped in Figure 6.

Table 13 Populations of *Acacia scalena*

Species	Population number	Location	Latitude	Longitude	Number of individuals
<i>Acacia scalena</i>	278	Approximately 0.5km south (outside) of the Project Area between SLK 128 and 129	-30.598542	116.7704	4
<i>Acacia scalena</i>	281	Approximately 0.5km south (outside) of the Project Area between SLK 128 and 129	-30.598818	116.7709	1
<i>Acacia scalena</i>	284	Approximately 0.5km south (outside) of the Project Area between SLK 128 and 129	-30.598528	116.7702	2
<i>Acacia scalena</i>	287	Approximately 0.5km south (outside) of the Project Area between SLK 128 and 129	-30.598433	116.77	1
<i>Acacia scalena</i>	290	Inside Project Area between SLK 129.5 to 129.6	-30.592492	116.7631	1
<i>Acacia scalena</i>	293	Approximately 180m west (outside) of Project Area between SLK 129.6 to 129.7	-30.592265	116.7609	1
<i>Acacia scalena</i>	296	Approximately 190m west (outside) of Project Area between SLK 129.6 to 129.7	-30.592195	116.7608	1
<i>Acacia scalena</i>	299	Approximately 5m west (outside) of Project Area between SLK 129.5 to 129.6	-30.592488	116.763	2
<i>Acacia scalena</i>	518	Approximately 350m south (outside) of the Project Area between SLK 128 and 129	-30.597726	116.7691	1

### 5.2.7 *Podotherca unisetata*

*Podotherca unisetata* is listed as a Priority 3 species which are “species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat” (DPaW, 2014). *Podotherca unisetata* was most likely given this conservation status as populations occur within several nature reserves.

*Podotherca unisetata* is a small basal spreading to prostrate annual herb growing to approximately 10 cm. It has distinctive red stems and narrow sessile sparse leaves and large yellow terminal flowers occurring from September to October.



**Plate 7** *Podotheca unisetata*

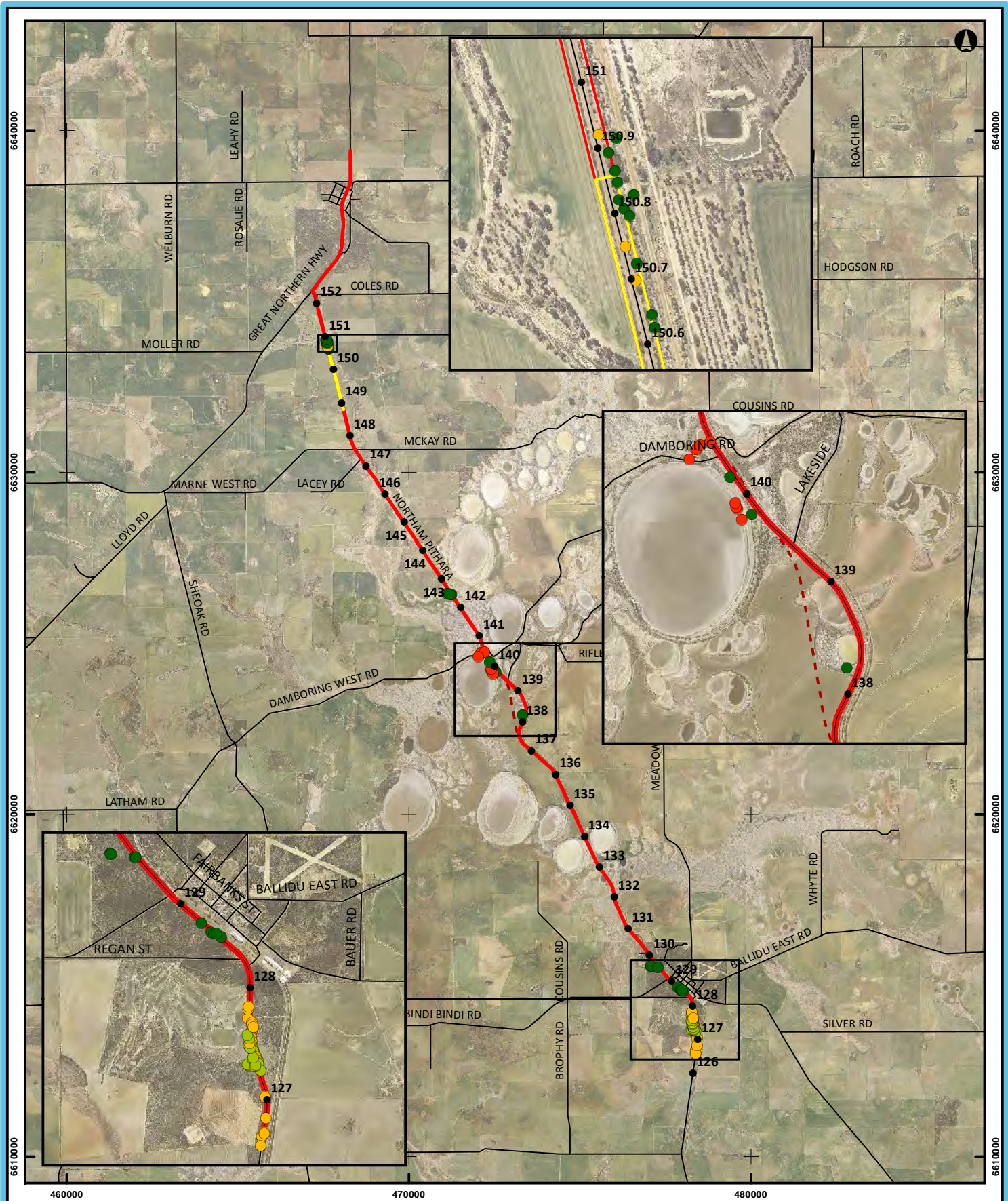
Preferred habitat is in loamy sandy soils in salty areas adjacent to salt lakes. *Podotheca unisetata* populations recorded during the Targeted Survey all occurred in salt lake areas in more open vegetation or degraded areas such as along old tracks and fence lines.

There are 21 known population records of *Podotheca unisetata*, which are relatively widespread from Perenjori in the north to Wongan Hills in the south. Several populations are known to occur within the Project Area, which don't appear to be any of the populations recorded during the targeted survey. *Podotheca unisetata* occurred in large patches along tracks and where the vegetation opened out in sparse patches of inter-vegetation areas. One population was recorded within the Project Area between SLK 142.4 and 142.5. All populations recorded during the targeted survey is listed in Table 14 and mapped in Figure 6.

Table 14 Populations of *Podotheca uniseta*

Species	Population number	Location	Latitude	Longitude	Number of individuals
<i>Podotheca uniseta</i>	302	Approximately 25m west (outside) of the Project Area between SLK 140.1 and 140.2	-30.511843	116.712	50
<i>Podotheca uniseta</i>	311	Approximately 50m west (outside) of the Project Area between SLK 140.1 and 140.2	-30.51458	116.7138	10
<i>Podotheca uniseta</i>	326	Approximately 20m west (outside) of the Project Area between SLK 142.4 and 142.5	-30.494021	116.7	40
<i>Podotheca uniseta</i>	329	Inside Project Area between SLK 142.4 and 142.5	-30.494118	116.7003	30
<i>Podotheca uniseta</i>	434	Approximately 80m west (outside) of the Project Area between SLK 138.2 and 138.3	-30.525855	116.7219	40
<i>Podotheca uniseta</i>	536	Approximately 80m west (outside) of the Project Area between SLK 142.2 and 142.3	-30.493892	116.6991	75



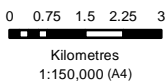


**Recorded Populations of Conservation Significant Species**

Northam-Pithara Rd DRF

Figure 6

Coordinate System: GDA 1994 MGA Zone 50



**LEGEND**

- Project Area
- Priority Area
- Proposed Road Realignment

**Recorded Species**

- T
- P1
- P2
- P3

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## 5.3 Level 2 Flora and Vegetation Survey - Realignment Section

### 5.3.1 Flora

A total of 51 flora species were recorded within the realignment area, with the most common family being Chenopodiaceae - salt bush family (9 taxa). A full list of species recorded during the survey is provided in Appendix B.

Three conservation significant species were recorded within the realignment section, this includes:

- *Frankenia conferta* (DRF)
- *Dampiera glabrescens* (P1)
- *Podotheca uniseta* (P3)

A total of four weed species were recorded within the realignment section, with the majority of weeds being grasses (Poaceae family). No Weeds of National Significance or Declared Plants declared under the *Biosecurity and Agricultural Management Act 2007* were recorded within the realignment section. Weeds occurring within the realignment section include:

- *Aira cupaniana*
- *Avena barbata*
- *Eragrostis curvula*
- *Ursinia anthemoides*

### 5.3.2 Vegetation

The vegetation within the realignment section was mapped into four distinct vegetation communities which have been previously mapped in the Project Area (AECOM, 2012). The vegetation communities include:

- *Eucalyptus* woodland
- Saline *Darwinia* heath
- Saline *Melaleuca* scrub
- Saline *Tecticornia* heath

A description of the vegetation communities is provided in Table 15 and mapped in Figure 7.

Table 15 Vegetation communities within the realignment section

Vegetation Unit Code	Vegetation Type	Description	Percentage of area	Size of area (ha)
ATSDdCLH	<i>Darwinia</i> heath	<i>Acacia acuminata</i> and <i>Melaleuca thyoides</i> Tall Shrubland over a <i>Darwinia diosmoides</i> Closed Low Heath over <i>Gunniopsis quadrifida</i> Scattered Herbland on pale brown sand in association with salt lakes	1.4	0.62
EILOWATOS	<i>Eucalyptus</i> woodland	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> Low Woodland to Low Open Woodland over <i>Acacia ermaea</i> Tall Shrubland over <i>Sarcocornia quinqueflora</i> , <i>Tecticornia indica</i> subsp. <i>bidens</i> and <i>Rhagodia drummondii</i> Low Open Chenopod Heath on light brown sandy loam in association with salt lakes.	Within the existing Project Area footprint	Within the existing Project Area footprint

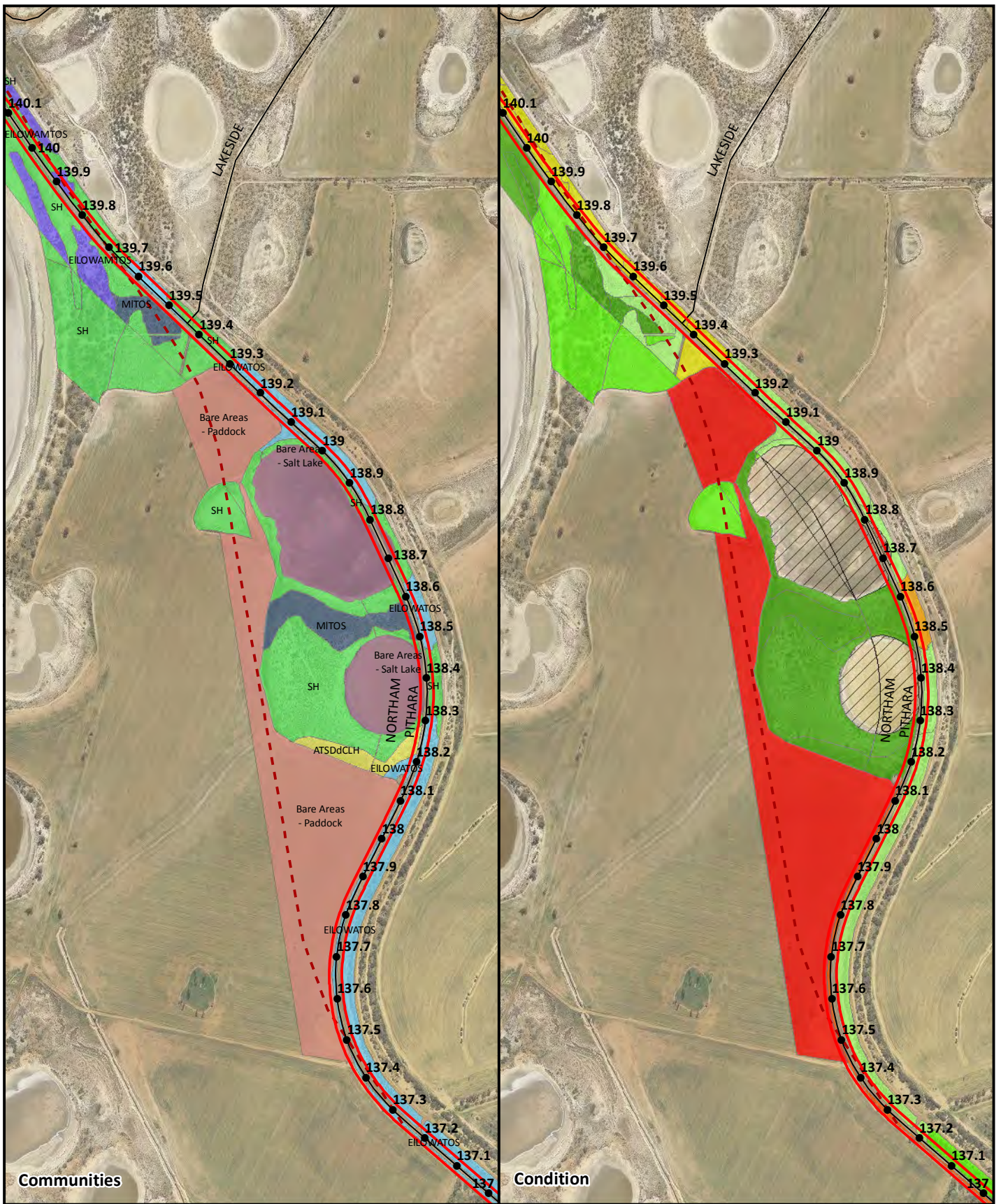
Vegetation Unit Code	Vegetation Type	Description	Percentage of area	Size of area (ha)
MITOS	<i>Melaleuca</i> scrub	<i>Acacia eremaea</i> , <i>Melaleuca hamata</i> and <i>Melaleuca lateriflora</i> Tall Shrubland over <i>Atriplex bunburyana</i> , <i>Rhagodia drummondii</i> and <i>Sclerolaena diacantha</i> Low Shrubland over <i>Tecticornia indica</i> subsp. <i>bidens</i> and <i>Tecticornia pergranulata</i> subsp. <i>pergranulata</i> Low Chenopod Heath on brown sandy loam with surface salt crusting	4.3	1.8
SH	Tecticornia heath	<i>Acacia eremaea</i> Scattered Tall Shrubs over <i>Tecticornia indica</i> subsp. <i>bidens</i> and <i>Tecticornia pergranulata</i> subsp. <i>pergranulata</i> Closed Low Succulent Heath on pale brown sandy loam with surface salt crusting on fringes of salt lakes	31.1	13.4
Bare areas – Paddock		Cleared paddocks – no native vegetation	50.6	21.8
Bare areas – Salt Lake		Salt lake – no vegetation present	12.6	5.4

No Threatened Ecological Communities occur within the realignment section. The *Eucalyptus* Woodland vegetation community (ELOWATOS) may be aligned with PEC 20 – Eucalypt Woodland of the Western Australian Wheatbelt (Priority 3), based on the presence of *Eucalyptus loxophleba* subsp. *supralaevis* in the canopy layer and that the vegetation community's structure is woodland, which are the key criteria for this PEC.

The majority of the realignment section was either salt lakes naturally bare of native vegetation or paddocks with no vegetation present.

The condition of the vegetation within the realignment ranged from Good to Very Good. Areas around tracks and fence lines had a higher percentage weed cover and were rated in Good condition. Paddocks that contained no native vegetation were rated completely degraded. Salt lakes that are naturally bare areas were not given a condition rating. The vegetation condition mapping for the realignment section is provided in Figure 7.



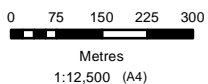


### Vegetation Communities and Condition

Northam-Pithara Rd DRF

Figure 7

Coordinate System: GDA 1994 MGA Zone 50



#### LEGEND

- Project Area
- Priority Area
- Proposed Road Realignment

#### Communities

- ATSDdCLH
- AcSaCTS
- AeSaTSMh
- Bare Areas - Paddock
- Bare Areas - Salt Lake
- Bare Areas - Salt Pan
- EWAIS
- EcTMMS
- EhTMATS
- ELOWAMTOS
- EIOTMMcLOS
- GSTOS
- GTSACOH
- MITOS
- Planted
- SH

#### Condition

- Bare Area - Salt Lake
- Bare Area - Salt Pan
- Completely Degraded
- Degraded
- Degraded to Good
- Good to Degraded
- Good
- Good to Very Good
- Very Good
- Very Good to Excellent

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## 6.0 Discussion

### 6.1 DRF Species

The targeted survey recorded two DRF species, *Eremophila viscida* and *Frankenia conferta*. Both these species were considered likely to (*F. conferta*) or may occur (*E. viscida*) within the Project Area. *Grevillea dryandroides* subsp. *dryandroides*, which was recorded during the 2012 survey of the Project Area (AECOM, 2012), was not recorded. Extensive searching was conducted in a number of areas containing suitable habitat and around known locations. This may be due to the size of the plant (less than 50 cm), however it has distinctive foliage and was expected to be flowering at the time of the survey (September to October).

Only one small population of four individuals of *Eremophila viscida* was recorded during the survey, which is mostly likely one of the 16 known populations as it was in the location provided by DPaW database searches. This population is next to a salt lake north of Damboring West Road over 100m outside the Project Area footprint.

Several additional populations of *Frankenia conferta* were recorded during the survey. *F. conferta* grows in association with salt lakes and appears to prefer growing above the high water mark, its boundary ended sharply at a number of salt lake fringes. Large patches of *F. conferta* were recorded between salt lakes that extended well outside the Project Area footprint.

### 6.2 Priority Flora Species

A total of five Priority Flora species were recorded during the targeted survey. All of the Priority Flora recorded during the 2012 survey of the Project Area (AECOM, 2012) were also recorded during this survey. Only two Priority Flora considered likely to occur within the Project Area were not found; *Caladenia cristata* (Priority 1) and *Synaphea constricta* (Priority 3). *C. cristata* was most likely not found due to its small size. One *Caladenia* spp. was collected at one location, however it was identified at the WAH as a different species. *S. constricta*, was searched for around several known locations and a number of suitable habitats. *S. constricta* has distinctive foliage and flowers and would be relatively easy to see.

*Dampiera glabrescens* is a disturbance-dependant species which occurs in disturbed niche spaces such as rail reserves, gravel pits and roadsides (DPaW, 2014b). *D. glabrescens* was only recorded along the road verge within the Project Area footprint. *D. glabrescens* is extensive throughout the Project Area (31 populations) and there is a risk that the project will clear a large proportion of these populations. However, clearing within the road verge may setup suitable niche spaces for *D. glabrescens*, creating “novel disturbances that mimic natural disturbance regimes which may expand or replace realized niche spaces, allowing the species to persist or even increase in population size.” (Pavlovic, 1994).

*Acacia lirellata* subsp. *compressa*, *Acacia dissona* var. *indoloria* and *Acacia scalena* also favoured growing within the road verge and favoured open area. A large proportion of the recorded populations may be cleared as part of the project. All three *Acacias* are disturbance opportunists so they may actually recover from clearing associated with the project.

*Podotheca uniseta* was not recorded during the 2012 survey (AECOM, 2012), most likely due to the timing of the previous survey in May. *P. uniseta* is an annual and most likely was dormant at the time of the previous survey. *P. Uniseta* was also considered unlikely to occur within the Project Area. The populations recorded within the Project Area represent new populations. *P. Uniseta* occurred in large populations and appeared to prefer more disturbed open areas such as tracks and along fencelines.

### 6.3 Realignment Section

The vegetation communities within the realignment section are an extension of the previous survey mapping (AECOM, 2012). The four vegetation communities mapped during this survey of the realignment section match previous mapping descriptions of structure and species composition.

One of the vegetation communities aligns with a Priority 3 PEC 20 – Eucalypt Woodland of the Western Australian Wheatbelt. Vegetation community EILOWATOS is a woodland and contains *Eucalyptus loxophleba* subsp. *supraevis* as its dominant overstorey species, these are the two criteria which determines this community to be this PEC.

The condition of the vegetation communities was mainly Very Good, however this reduced along tracks and fencelines. Three of the four weed species are grasses most likely spread from adjacent paddocks.

## 7.0 Conclusion and Recommendations

The significant ecological findings from the survey are:

- two DRF species recorded – *Eremophila viscida* and *Frankenia conferta*
- five Priority Flora species recorded - *Dampiera glabrescens*, *Acacia lirellata* subsp. *compressa*, *Acacia dissona* var. *indoloria*, *Acacia scalene* and *Podotrochea uniseta*
- four vegetation communities within the realignment section
- one potential PEC in the realignment section – PEC 20 – Eucalypt Woodland of the Western Australian Wheatbelt
- one DRF species (*Frankenia conferta*) recorded within the realignment section
- two Priority Flora species (*Dampiera glabrescens* and *Podotrochea uniseta*) in the realignment section
- four weed species within the realignment section, none of which are Weeds of National Environmental Significance or Declared Plants declared under the BAM Act.

Based on the findings of the survey of the Project Area, the following recommendations have been provided:

- minimise clearing of native vegetation where possible
- minimise clearing of the Priority Flora species whose only habitat is within the road verge – *Dampiera glabrescens*
- avoid populations where possible of Priority Flora species favouring habitat within the road verge – *Acacia lirellata* subsp. *compressa*, *Acacia dissona* var. *indoloria* and *Acacia scalene*
- minimise clearing of the potential PEC 20 – Eucalypt Woodlands of the Western Australian Wheatbelt, which is the *Eucalyptus loxophleba* subsp. *supralaevis* woodland vegetation community (ELOWAMTOS).

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Appendix A

# Conservation significant species potentially occurring within the Project Area

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## Appendix A Conservation significant species potentially occurring within the Project Area

Table 16 Conservation significant species potentially occurring within the Project Area

Species	Conservation Status	Description and Flowering Period	Habitat	Likelihood of Occurrence in Survey area
<i>Caladenia drakeoides</i>	Threatened – Critically Endangered	Tuberous, perennial, herb, 0.12-0.3 m high. Flowers green from September to October.	Grey clayey sand, red sandy loam, in damp situations. Margins of salt lakes.	<i>May Occur</i> – There are four records of this species in the vicinity of the road reserve and an additional three records along the nearby Meadows Road. <i>Caladenia drakeoides</i> has a preference for habitats on the margins of salt lakes.
<i>Dasymalla axillaris</i>	Threatened – Critically Endangered	Compact, spreading shrub to 30 cm tall. Tomentose grey foliage. Pale red-pink to apricot coloured flowers, in December.	Sandy or sandy clay soils. Plains, flats and along road and rail reserves	<i>Unlikely to Occur</i> – There is one record of this species within the cleared railway crossing at Pithara. This record was from 1963. Recent conservation advice (DSEWPAC, 2010) indicates that this species is only known from eight populations in the Morawa area (approximately 150 km north of Pithara).
<i>Eremophila pinnatifida</i>	Threatened – Critically Endangered	Shrub, ca 0.6 m high. Flowers purple during September	Clay and loam soils. Plains, low lying areas and along road verges	<i>May Occur</i> – There are five records of this species near Dalwallinu approximately 12 km north of the Project Area. <i>Eremophila pinnatifida</i> occurs along road verges.
<i>Grevillea dryandroides</i> subsp. <i>dryandroides</i>	Threatened – Critically Endangered	Lightly suckering shrub, 0.1-0.5 m high. Flowers red/pink-red from September to October or February.	Yellow sand & gravel, clay. Plains and slopes.	<i>Likely to Occur</i> – There are a number of records around Ballidu and one record north of Pithara. The Project Area is likely to contain suitable habitat to support this species.
<i>Grevillea pythara</i>	Threatened – Critically Endangered	Suckering shrub, 0.06-0.3 m high. Flowers orange and red and blue from May to Oct (possibly all year).	Sand or sandy loam with gravel.	<i>May Occur</i> – There are two records of this species within the road reserve. One (from 1991) is at Pithara and the other (1992) is just north of Pithara, recorded growing in a weedy road verge. The interim recovery plan for this species (Philimore et al., 2001) indicates that only one population of this species was known at the time from south west of Dalwallinu, growing in a shire road reserve.

Species	Conservation Status	Description and Flowering Period	Habitat	Likelihood of Occurrence in Survey area
<i>Daviesia dielsii</i>	Threatened - Endangered	Divaricate shrub, 0.5-0.9 m high. Flowers orange and red from July to August	Sandy, often gravelly soils. Plains and road reserves, also occurs on breakaway hillsides	<i>Unlikely to occur</i> – There are 15 known records in the Moora to Watheroo area which is over 70km from the Project Area. <i>Daviesia dielsii</i> is known to occur within degraded roadside verges. It is considered to unlikely to occur due to the distance from its known range.
<i>Eremophila viscida</i>	Threatened – Endangered	Shrub, 1.2-4 m high. Flowers green-white-yellow from September to November.	Granitic soils, sandy loam. Stony gullies, sandplains.	<i>May Occur</i> – There is one previously recorded population at Ballidu, however this population recorded in 1934 is no longer thought to occur (Philimore et al., 2003). There are three known populations on private land south east of Pithara. This species is thought to prefer areas associated with salt lake systems, so there is likely to be suitable habitat within the survey area.
<i>Grevillea bracteosa</i> subsp. <i>bracteosa</i>	Threatened – Endangered	Tall, erect, open shrub, 1 - 2 m high. Flowers pink from August to December	Clay, loam soils over laterite. Lateritic ridges, slopes and hilltops.	<i>Unlikely to Occur</i> – There are three records within 1 km south of Dalwallinu and within 12 km from the Project Area. <i>Grevillea bracteosa</i> subsp. <i>bracteosa</i> is unlikely to occur within the Project Area as it does not contain suitable habitat to support this species.
<i>Eremophila vernicosa</i>	Threatened – Vulnerable	Erect, spindly spreading shrub to 3 m high. Flowers white during September	Clay loamy soil over laterite. Breakaways and slopes.	<i>Unlikely to Occur</i> – There are two records near Wubin approximately 30 km north of the Project Area. Habitat is unlikely to be present within the Project Area to support <i>Eremophila vernicosa</i>
<i>Frankenia conferta</i>	Threatened – Endangered	Low, compact, domed shrub to 0.25 m. Small grey leaves. Flowers white-pink during September to November	Loamy sand. Within salt lakes and drainage lines	<i>Likely to Occur</i> – There is one population of this species in the vicinity of the road reserve in association with Damboring Lake and the chain of salt lakes which intersect the survey area. In 2008 this population was recorded and was noted to be healthy and comprising of approximately 76 individuals (DEC, 2009).

Species	Conservation Status	Description and Flowering Period	Habitat	Likelihood of Occurrence in Survey area
<i>Acacia</i> sp. Petrudor Rocks (B.R. Maslin 7714)	Priority 1	Dense, rounded, spreading shrub, to 1 m high (by 2m wide), phyllodes flat, 7-20 mm long; inflorescence simple or racemose, heads globular. Flowers yellow from July to September.	Loam or clayey loam over granite. Upper slopes of catchment area.	<i>May Occur</i> – The nearest record to the survey area is approximately one kilometre south of Ballidu within the road reserve. This is a population of approximately eight plants which was recorded in 2010. There are two additional populations in the vicinity of Ballidu which were recorded in 2010 and are made up of approximately eight and 17 individuals.
<i>Acacia trinalis</i>	Priority 1	Dense, rounded, bushy shrub or tree, 1.5-4 m high. Flowers yellow during September.	Brown sand, clay loam. Salt lakes & flats, swampy areas.	<i>May Occur</i> – There is one record of this species from 1987 approximately four kilometres west of the road reserve. <i>Acacia trinalis</i> is considered to may occur due to its preference for salt lakes and salt flats.
<i>Caladenia cristata</i>	Priority 1	Tuberous, perennial, herb, 0.18-0.4 m high. Flowers green and red from August to September.	Sandy clay. Sandy rise above salt flats, freshwater.	<i>Likely to Occur</i> – There is one record of this species within the Project Area occurring in association with the chain of salt lakes which intersect the survey area.
<i>Caladenia x ornata</i>	Priority 1	Herb, 0.15-0.2 m high, single flowered. Flowers yellow-red-green.	Sandy clay. Margins salt lakes, slight rises, under <i>Melaleuca</i> and <i>Acacia acuminata</i> .	<i>May Occur</i> – There is one record of this species within the road reserve in the vicinity of Pithara. This record (originally recorded in 1988) is the only known record of <i>Caladenia x ornata</i> .
<i>Dampiera glabrescens</i>	Priority 1	Erect perennial, herb, 0.2-0.5(-0.9) m high. Flowers purple-blue during September.	White or grey/yellow sand. Gravel pits, roadsides.	<i>Likely to Occur</i> – There are eight records of this species within the vicinity of the survey area. Six of these records occur at Ballidu, with three within the nearby rail reserve and two within the road reserve. One recorded occurrence of <i>Dampiera glabrescens</i> from within the road reserve was from 1986 and it was noted to occur on the graded road shoulder, ditches and table drains. It was also recorded nearby in 2007.
<i>Grevillea pinifolia</i>	Priority 1	Much-branched shrub, 0.3-0.6(-0.9) m high. Flowers red from July to October.	Yellow sand, gravel. Slopes and gravelly rises	<i>Unlikely to Occur</i> – There is one record approximately 32 km north east of the Project Area near Miling. This record was from 1969, other records occur further north-west near Coroow (approximately 90 km from the Project Area)

Species	Conservation Status	Description and Flowering Period	Habitat	Likelihood of Occurrence in Survey area
<i>Verticordia roei</i> subsp. <i>meiogona</i>	Priority 1	Corymbose shrub, 0.3-0.6 m high. Flowers cream/pink from September to October.	Yellow sand, sandy loam with gravel. Roadside verges.	<i>May Occur</i> – There is one record approximately 10 km south-east of Dalwallinu near the Project Area.
<i>Acacia lirellata</i> subsp. <i>compressa</i>	Priority 2	Bushy procumbent, spreading shrub, ca 0.5 m high, to 1.2 m wide. Flowers yellow during September.	Yellow sand, clayey loam. Sandplains.	<i>Likely to Occur</i> – There are five records of this species in the vicinity of Ballidu with three records occurring within the road reserve.
<i>Boronia ericifolia</i>	Priority 2	Erect shrub, 0.3-1.2 m high. Flowers white/cream to yellow, April or Jun or August to September.	Sandy loam, clay, laterite. Low-lying spots.	<i>May Occur</i> – There are four records of this species in the vicinity of the survey area, with three occurring within the road reserve. These occurrences were originally recorded in 1992, therefore the current status of the populations are unknown.
<i>Calandrinia kalanniensis</i>	Priority 2	Semi-erect to erect tuberous, perennial, herb, to 0.09 m high. Fl. pink-white, from November to December or January	Shallow brown clay, often gritty, derived from eroded granite. Rock outcrops, herbfields.	<i>Unlikely to Occur</i> – There are several records of this species east of Kalannie approximately 75km from the Project Area. The Project Area is unlikely to contain habitat to support <i>Calandrinia kalanniensis</i> .
<i>Eremophila sargentii</i>	Priority 2	Shrub, 0.3-2 m high. Flowers purple to blue, from August to October.	Laterite, sandy loam. Sandplains, hills.	<i>Unlikely Occur</i> – There is several records along the Northam-Pithara Road with the closest recorded in 1968 approximately 7 km south of the Project Area.
<i>Grevillea kenneallyi</i>	Priority 2	Spreading, dense shrub, 1.2-3 m high. Flowers white, from July to September.	Gravelly loam, laterite. Breakaways, lateritic ridges and slopes	<i>Unlikely to Occur</i> – There is one record of this species from 1963 in the vicinity of the road reserve at Ballidu. It is unknown whether this population still persists.
<i>Petrophile trifurcata</i>	Priority 2	Shrub, 0.3-0.65 m high. Flowers yellow during September.	Sandy and loamy soils	<i>Unlikely to Occur</i> – There is one record of this species 10 km west of Pithara.

Species	Conservation Status	Description and Flowering Period	Habitat	Likelihood of Occurrence in Survey area
<i>Scholtzia</i> sp. Gunyidi (J.D. Briggs 1721)	Priority 2	Prostrate shrub, 0.05-0.1 m high, to 1 m wide. Flowers pink during October.	Sandy loam. Gentle slopes.	<i>Unlikely to Occur</i> – There are several records of this species located between Watheroo and Gunyidi over 60 km west of the Project Area.
<i>Acacia dissona</i> var. <i>indoloria</i>	Priority 3	Domed or rounded, dense, pungent shrub, 0.5-2 m high. Flowers yellow, from August to September.	Sand, sandy loam. Undulating plains.	<i>May Occur</i> – There is one record of this species within approximately 500 metres of the road verge. This is close to an area where the road is adjacent to what appears to be a larger area of remnant vegetation. There are 18 records of this species at the WA herbarium and these records indicate that several have been found in areas of disturbed soil on road verges.
<i>Acacia scalena</i>	Priority 3	Intricately branched, rigid, often straggly, prickly shrub, 0.5-1.5 m high. Flowers yellow, from June to September.	Yellow or yellow gravelly sand, loam. Plains and road verges.	<i>May Occur</i> – There are four records of this species in the vicinity of Ballidu, with one occurring within the road reserve. Several of these records are recent (2009-2010), however the record from within the road reserve was originally recorded in 1958.
<i>Angianthus micropodioides</i>	Priority 3	Erect or decumbent annual, herb, 0.03-0.15 m high. Flowers yellow-white, from November to December or January to February.	Saline sandy soils. River edges, saline depressions, claypans	<i>May Occur</i> – There is one record of this species approximately four kilometres east of the survey area. This species is known to occur in association with salt lakes, which run through the survey area.
<i>Austrostipa blackii</i>	Priority 3	Tufted perennial, grass-like or herb, 1 m high. Flowers from September to November.	Shallow sandy clay soils. Rocky slopes.	<i>Unlikely to Occur</i> – There two closest records are around the Dalwallinu town site approximately 15 km north of the Project Area. The Project Area is not likely to contain habitat able to support <i>Austrostipa blackii</i>
<i>Bossiaea concinna</i>	Priority 3	Erect, prickly shrub, 0.4-1.5 m high. Flowers yellow and red/brown, from June to September.	White or red sand, gravel. Lower slopes and valleys.	<i>Unlikely to Occur</i> – There are no records in the vicinity of the survey area. The nearest record is north-east of Pithara.
<i>Calytrix plumulosa</i>	Priority 3	Shrub, 0.15-0.4 m high. Flowers pink-violet, from October to November.	Sand with lateritic gravel, loamy soils. Plains	<i>May Occur</i> – The closest record of this species is near Dalwallinu approximately 15 km north of the Project Area.



Species	Conservation Status	Description and Flowering Period	Habitat	Likelihood of Occurrence in Survey area
<i>Chamelaucium</i> sp. Wongan Hills (B.H. Smith 1140)	Priority 3	Low, prostrate, spreading shrub to 0.4 m. Flowers pink September to November	Sand, sandy loam, low lying flats and margins of salt lakes	<i>May Occur</i> – There is one record of this species approximately 16 kilometres west of Ballidu. There are no records in close proximity to the survey area, however suitable habitat may occur.
<i>Dicrastylis reticulata</i>	Priority 3	Woolly shrub, (0.15-)0.6-1.2(-1.5) m high. Flowers white, from September to December.	Sandy soils, often over granite. Amongst granite rock, hills, flats.	<i>Unlikely to Occur</i> – There are two records of this species between Kalannie and Pithara from 1938. There are no records in close proximity to the survey area.
<i>Dicrastylis velutina</i>	Priority 3	Shrub, 0.1-0.6 m high. Flowers white, from October to December.	Sandy soils, gravelly loam. Salt lakes	<i>May Occur</i> – There are three records of this species near the Wongan Hills townsite approximately 30 km south of the Project Area. As there are a number of salt lakes within the Project Area there is a potential that <i>Dicrastylis velutina</i> may occur within the Project Area
<i>Eucalyptus subangusta</i> subsp. <i>virescens</i>	Priority 3	Mallee, 2-5 m high, bark smooth. Flowers white-cream during April.	Yellow sand, white clay. On slopes, sand plains and flats.	<i>Unlikely to Occur</i> – There is one record of this species within 15 km of the Project Area.
<i>Gastrolobium rotundifolium</i>	Priority 3	Erect, bushy shrub, to 0.8 m high. Flowers orange-yellow-red, from August to September.	Heavy clay or loam soils, granite, sandstone, quartzite. Low rises, breakaways.	<i>Unlikely to Occur</i> – The nearest records are west of Bindi Bindi approximately 48 km from the Project Area. The Project Area is unlikely to support suitable habitat for <i>Gastrolobium rotundifolium</i> .
<i>Gompholobium wonganense</i>	Priority 3	Erect, spreading shrub, to 1.2 m high. Flowers yellow, from September to November.	Sand, laterite. Among hills.	<i>May Occur</i> - There is one record of this species in the vicinity of the road reserve at Ballidu. It is unknown whether this population still persists as the original collection was made in 1934. There are six records of <i>Gompholobium wonganense</i> at the WA Herbarium, the majority of these are from Wongan Hills and surrounds occurring in lateritic soils.
<i>Goodenia perryi</i>	Priority 3	Herb or shrub, 0.15-0.3 m high. Flowers blue, from October to November.	Yellow sand. On sand plains	<i>May Occur</i> – There is one record of this species approximately 500 metres west of the road reserve at Ballidu. This record is from 1977 and it is unknown whether this population still occurs at this location, however other records indicate that this species may have a preference for disturbed sites and road edges.

Species	Conservation Status	Description and Flowering Period	Habitat	Likelihood of Occurrence in Survey area
<i>Grevillea asparagoides</i>	Priority 3	Dense prickly shrub, 0.5-2 m high. Flowers red, from July to October or December.	Gravelly loam, white or yellow sand. Slopes, plains and road verges.	<i>May Occur</i> – There are three records of this species near Wongan Hills approximately 25 km south of the Project Area.
<i>Grevillea candicans</i>	Priority 3	Bushy, non-lignotuberous shrub, 1-5 m high. Flowers white/cream-white, from August to October.	Deep yellow sand. Sandplains.	<i>May Occur</i> – There is one record of this species east of Dalwallinu 17 km north east of the Project Area.
<i>Gunniopsis rubra</i>	Priority 3	Small prostrate herb to 0.05 m. Flowers green-yellow from August to September	Sandy loamy clay. Flats and foot of slopes.	<i>May Occur</i> – There is one record of this species approximately 700 metres east of the road reserve, two kilometres south of Ballidu. Although recorded in 1977, this species may still occur in the area as there is still some persisting remnant vegetation in the area.
<i>Lepidobolus densus</i>	Priority 3	Rhizomatous, caespitose perennial, herb (sedge-like), to 0.4 m high. Flowers during August	Yellow lateritic sand, lateritic gravel. Dry Kwongan.	<i>May Occur</i> – There are two records of this species in the vicinity of the survey area, with one occurring within the road reserve. The records are both from 1947 and it is unknown whether these populations still persist.
<i>Melaleuca sclerophylla</i>	Priority 3	Erect-spreading to prostrate shrub, 0.15-0.9 m high. Flowers purple-pink, from June to September.	Gravelly sand, clayey sand. Granite outcrops, rises.	<i>Unlikely to Occur</i> – There are several records of this species located near Wongan Hills approximately 30 km south of the Project Area. The Project Area is not likely to support suitable habitat for <i>Melaleuca sclerophylla</i>
<i>Petrophile globifera</i>	Priority 3	Branching, erect, shrub to 1 m. Dark green leaves. Flowers cream during September	Deep sand. Top of slopes and on sand plains	<i>Unlikely to Occur</i> - There are no records in the immediate vicinity of the survey area. The nearest record is approximately 10 km west of Pithara. There are no specific habitat preferences to suggest that this species would occur in the survey area.

Species	Conservation Status	Description and Flowering Period	Habitat	Likelihood of Occurrence in Survey area
<i>Podotheca uniseta</i>	Priority 3	Erect, semi-succulent herb to 0.15 m high. Flowers yellow, from September to October	White/grey sand, sandy loam. Samphire flats, salt lake areas.	<i>May Occur</i> - There are three records of this species in the vicinity of the survey area, one occurs in the vicinity of the railway crossing at Pithara and was recorded in 1989. It is unknown whether this species still persists at this location, however it is likely that there is currently suitable habitat within the survey area as many WA Herbarium records indicate that this species has a preference for habitats associated with salt lakes.
<i>Synaphea constricta</i>	Priority 3	Compact, tufted shrub, 0.2-0.5 m high. Flowers yellow, from June to September.	Sand or sandy clay-loam over laterite. Plains and slopes	<i>Likely to Occur</i> – There are two records of this species in the vicinity of the survey area, with the most recent record in 1998 from near the road verge.
<i>Tecticornia fimbriata</i>	Priority 3	Erect shrub, 0.25-1 m high.	Clay, loam. Margins of salt & gypsum lakes.	<i>May Occur</i> – There is one record of this species approximately two kilometres east of the road reserve at Ballidu in 1968. Despite the age of this record and distance from the road reserve, this species is still considered a possibility to occur due to the existence of suitable habitat within the survey area.
<i>Urodon capitatus</i>	Priority 3	Low spreading or upright shrub to 1.2 m high and to 1 m wide. Flowers yellow-orange-red, from September to October.	Sandy gravelly soils. Plains.	<i>May Occur</i> - There are three records of this species in the vicinity of the road reserve at Ballidu. They are historical records from 1934 – 1942 and it is unknown what the current status of this population is, however this species is still considered a possibility to occur as there is persisting remnant vegetation in this area.
<i>Verticordia venusta</i>	Priority 3	Erect, spreading shrub, 0.2-2 m high. Flowers pink-purple/red-brown, from September to December or January.	Yellow sand, sandy gravel. Sandplains.	<i>May Occur</i> – There are four records of this species in the vicinity of the road reserve between Ballidu and Pithara. The records are from 1962 to 1981 and it is not known whether they still persist at this site. <i>Verticordia venusta</i> is still considered possible to occur as the collections occur from Ballidu to Pithara, not just in one single location and there is remnant vegetation within the survey area that may provide suitable habitat.

## Appendix B

# Flora species recorded during the survey

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Table 17 Flora species recorded during the survey

Family	Species	Conservation Status	Weed
Fabaceae	<i>Acacia acuaria</i>		
Fabaceae	<i>Acacia acuminata</i>		
Fabaceae	<i>Acacia burkittii</i>		
Fabaceae	<i>Acacia daphnifolia</i>		
Fabaceae	<i>Acacia dissona</i> var. <i>indoloria</i>	Priority 3	
Fabaceae	<i>Acacia ermaea</i>		
Fabaceae	<i>Acacia lirellata</i> subsp. <i>compressa</i>	Priority 2	
Fabaceae	<i>Acacia scalena</i>	Priority 3	
Poaceae	<i>Aira cupaniana</i>		Yes
Amaranthaceae	<i>Alternanthera</i> sp.		
Myrtaceae	<i>Aluta aspera</i>		
Chenopodiaceae	<i>Atriplex bunburyana</i>		
Poaceae	<i>Austrostipa nitida</i>		
Poaceae	<i>Avena barbata</i>		Yes
Asteraceae	<i>Brachyscome iberidifolia</i>		
Portulacaceae	<i>Calandrinia ermaea</i>		
Lauraceae	<i>Cassytha racemosa</i>		
Haemodoraceae	<i>Conostylis aculeata</i> subsp. <i>bromelioides</i>		
Goodeniaceae	<i>Dampiera glabrescens</i>	Priority 1	
Myrtaceae	<i>Darwinia diosmoides</i>		
Hemerocallidaceae	<i>Dianella revoluta</i>		
Chenopodiaceae	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>		
Poaceae	<i>Enteropogon ramosus</i>		
Poaceae	<i>Eragrostis curvula</i>		Yes
Scrophulariaceae	<i>Eremophila papillata</i>		
Scrophulariaceae	<i>Eremophila viscida</i>	DRF	
Myrtaceae	<i>Eucalyptus loxophleba</i> subsp. <i>supraevis</i>		
Santalaceae	<i>Exocarpos aphyllus</i>		
Frankeniaceae	<i>Frankenia conferta</i>	DRF	

Family	Species	Conservation Status	Weed
Frankeniaceae	<i>Frankenia laxiflora</i>		
Asteraceae	<i>Gnephosis angianthoides</i>		
Proteaceae	<i>Grevillea levis</i>		
Aizoaceae	<i>Gunnipopsis quadrifida</i>		
Chenopodiaceae	<i>Maireana amoena</i>		
Chenopodiaceae	<i>Maireana brevifolia</i>		
Myrtaceae	<i>Melaleuca atroviridis</i>		
Myrtaceae	<i>Melaleuca hamata</i>		
Myrtaceae	<i>Melaleuca lateriflora</i>		
Myrtaceae	<i>Melaleuca lateralis</i>		
Myrtaceae	<i>Melaleuca thyoides</i>		
Rutaceae	<i>Microcybe multiflora</i> subsp. <i>multiflora</i>		
Fabaceae	<i>Mirbelia ramulosa</i>		
Rutaceae	<i>Phebalium ambiguum</i>		
Rutaceae	<i>Philotheca deserti</i> subsp. <i>deserti</i>		
Poaceae	<i>Poaceae</i> sp.		
Asteraceae	<i>Podolepis lessonii</i>		
Asteraceae	<i>Podotrochea unisetata</i>	P3	
Asteraceae	<i>Pogonolepis muelleriana</i>		
Chenopodiaceae	<i>Rhagodia drummondii</i>		
Chenopodiaceae	<i>Sarcocornia quinqueflora</i>		
Aizoaceae	<i>Sarcozona praecox</i>		
Chenopodiaceae	<i>Sclerolaena diacantha</i>		
Chenopodiaceae	<i>Tecticornia indica</i> subsp. <i>bidens</i>		
Chenopodiaceae	<i>Tecticornia pergranulata</i> subsp. <i>pergranulata</i>		
Asteraceae	<i>Ursinia anthemoides</i>		Yes